John Bloomfield Jervis, Hon. M. Am. Soc. C. E.*

In the death of John Bloomfield Jervis, at Rome, N. Y., on the night of January 12th, 1885, the country lost another of those remarkable men bequeathed to this generation by the latter part of the eighteenth century, whose talents and energies have for seventy years been directed toward building up the wonderful system of internal improvements which marked the history of the nation during the present century.

Mr. Jervis was born at Huntington, Long Island, December 14th, 1795, and was consequently in his 90th year at the time of his death. His father was Timothy Jervis, a carpenter by trade, and a resident of Huntington. His mother was Phœbe Bloomfield of Woodbridge, New Jersey. The brother of Mrs. Jervis, John W. Bloomfield, went to Fort Stanwix, now Rome, N. Y., from New Jersey, to act as agent for, and to look after a large tract of land in that vicinity, which resulted in the purchase for himself and two or three others of the "six thousand-acre tract." He soon after settled in what is now the town of Annsville, which was named after his wife. About 1812 he removed to Rome, purchased a farm, which included the homestead of Mr. Jervis, and lived and died in a house which then occupied the site of Mr. Jervis' late residence. His death occurred in 1849, at the age of eighty-four. He was widely known, and universally honored and esteemed.

In 1798, Timothy Jervis moved to Fort Stanwix, which was chiefly prominent as having a navigable canal of about two miles in length connecting the Mohawk River with Wood Creek. By connecting improvements in the form of locks and dams on the Mohawk River and Wood Creek, it formed part of a system of improvements connecting the natural navigation through a large portion of the State of New York. By these means barges or bateaux passed from Schenectady, on the Mohawk, to Ithaca, at the head of Cayuga Lake. The country was at this time mostly a wilderness of heavy timber, and Timothy Jervis soon became interested in a saw-mill, which was attended by himself and his sons. John B. Jervis was the oldest of seven children and had the experience of the trials of a settlement in a new country. What education he had was obtained at the common schools of that day, which he attended until he was fifteen years of age. There were then no public schools sustained in whole or in part by the State. Between the ages of fifteen and twenty-two he spent his summers in managing a team and attending the saw-mill, with occasional farm-work, and during the winters he was engaged in hauling saw-logs and wood.

In 1817, the construction of the Erie Canal was commenced, and the work afforded employment and furnished facilities to a large class who had heretofore followed other pursuits. Benjamin Wright, more generally known as "Judge" Wright, was Chief Engineer in the construction. Judge Wright resided in Rome, and therefore knew Mr. Timothy Jervis and his sons. Needing an axman he applied to Mr. Jervis, who suggested that he should take John, which was the beginning of what afterward became the remarkable engineering career of John B. Jervis, who then turned his attention to the study and practice of surveying and engineering. Dexterous with an ax, apt and ambitious to learn, ready to do all and more than was required, he was soon promoted to the position of rodman in the survey, at $12 per month, in which he reached such proficiency, that in two years he was made Resident Engineer on seventeen miles of the canal, extending from Canastota, Madison County, to Limestone Creek, in Onondaga County, at a compensation of $1.25 per day. Mr. Jervis was then about twenty-five years of age, and although the young engineers of to-day might smile at an offer of $1.25 per day, that position and salary, sixty-five years ago, were considered very desirable and lucrative.

Mr. Jervis records, in some notes which he has left for the purpose of memoir, that after filling a winter engagement for weighing stone for locks, he started for Rome, a distance of forty miles, on foot, traveling four miles on the evening of the first day, to a village where he and his associates spent the first night, and thence started at daylight to walk thirty-six miles to Rome, over melting snow, which made the traveling very heavy and disagreeable, reaching Rome about 9 o'clock in the evening, pretty well fatigued, but hardly the worse for it the next day. During this period Mr. Jervis was under the direction of Judge Bates as chief of the party, and Canvass White, well known among New York engineers, as the principal assistant.

In the spring of 1820, he became well acquainted with Henry Seymour (father of Hon. Horatio Seymour), who was one of the Canal Commissioners, and with whom Mr. Jervis had had frequent intercourse in relation to his duties. In the spring of 1821, Mr. Jervis was assigned the position of Resident Engineer to the division extending from "The Nose" to opposite the village of Amsterdam, about seventeen miles, Mr. Seymour being the Commissioner of that division. He retained the charge of this division until the close of 1822, when it was mostly completed, and the party was disbanded, except himself. He was retained to aid in the settlement of the accounts of the contractors, which occupied his time for the balance of the year. This work was discharged with such acceptability that he was retained by Commissioner Seymour, in the opening of the season of 1823, to take charge of such work as still remained to be done on the canal between the Minden dam and the Upper Mohawk aqueduct, a section of fifty miles. It was then made his duty to organize parties of men to superintend the work of repairs and such incidental improvements as were found necessary to bring the section into use for navigation.

The custom was, at that day, to stop small leaks in the canal by dumping in clay, but Mr. Jervis records that, "finding the clay not satisfactory in the leaks that occurred, I made trial of fine gravel intermixed with sharp sand, which, while it did not fully stop the leak at the first application, was not sensibly carried away, and the interstices being small they were gradually filled up, and the work became tight," which marked a decided advance in the mode of repairing leaks, and was illustrative of the care with which Mr. Jervis always investigated details. In the spring of 1825 the canal was opened to Albany, and Mr. Jervis was continued as the Superintendent Engineer on the same division. During that year and until March, 1825, he had full charge of the entire section from Amsterdam to Albany, and all accounts for labor and material passed through his hands. He records the fact that the actual cost of operating the section of fifty miles for one year, including lock tenders and all expenses, except those for the collection of tolls, was at the rate of $600 per mile.

Mr. Canvass White, the principal Assistant Engineer, left the State service for other work in 1823, and as Judge Wright, the Chief Engineer, had many calls for his service on canal enterprises in other States, the entire responsibility for the section referred to was thrown upon Mr. Jervis and Mr. Seymour, the Canal Commissioner.

After seven years' employment on the Erie Canal, Mr. Jervis closed his services by resignation early in the month of March, 1825, very much to the regret of Mr. Henry Seymour, who gave him warm testimonials. Mr. Jervis went to New York and had an interview with Judge Wright, who had entered into an engagement with the Delaware and Hudson Canal Company, which resulted in the engagement of Mr. Jervis as Chief Engineer of that company, with Judge Wright as Consulting Engineer. Preliminary surveys and estimates had been made for the construction of a water route, partly canal and partly slack-water; but Mr. Jervis, after a careful investigation, decided against most of the slack-water plan, his decision being approved by Judge Wright. Near the close of 1827 Judge Wright resigned, and Mr. Jervis was appointed to succeed him, and remained in charge of the work until 1830. During this time he constructed the inclines of the Carbondale Railroad and ordered from England the "Stourbridge Lion," the first locomotive imported into this country, which, with two others, were ordered about a year before the famous trial on the Liverpool and Manchester Railway, indicating Mr. Jervis' extraordinary foresight and courage. This locomotive, Mr. Jervis states, was bought under an order from him for a locomotive which should not exceed 5½ tons in weight. The "Stourbridge Lion" actually weighed 7 tons, exclusive of coal and water, with the proper complement of which its weight was 8 tons, and consequently in excess of the weight which the trestles of the Carbondale road were built to sustain, and hence the locomotive could not be used. But the criticism that the trestles were too weak for their intended purpose is negatived by the fact that they bore in the first twenty years the transit of about 5,000,000 tons of coal. Mr. Jervis is certainly entitled to the credit of having introduced the first locomotive on the American continent, and its failure to be serviceable was not due to any error of his.

The works of the Delaware and Hudson Canal and Railroad were completed in the fall of 1829, and a few boats loaded with coal were transported to tide-water on the Hudson. Mr. Jervis records that at this time he employed Mr. John H. McAlpine to superintend the construction of machinery, who introduced his son, William J. McAlpine, then about sixteen years of age, and requested a place for him. Mr. McAlpine's widely-known engineering reputation started with that introduction.

In 1830, Mr. Jervis was appointed Chief Engineer of the Albany and Schenectady Railroad, the first railroad constructed in the State of New York.

Mr. Jervis subsequently became Chief Engineer of the Schenectady and Saratoga Railroad, and while occupying this position, in 1830, his attention was drawn to the inadequacy of the locomotives of the then existing plan for high speed. This was especially noticeable in the action of the second engine imported for the Albany and Schenectady Railroad, called the "John Bull," the first having been named the "De Witt Clinton." Mr. Jervis says of the "John Bull": "It being placed on four wheels, the overhanging caused a sharp and disagreeable motion of the engine. This circumstance, with others, induced me to continue my researches for a remedy for the weight, and to secure a more steady motion for the engine, and I was finally led to the plan of a four-wheeled truck under the forward portion of the engine as a support for that end." Mr. Jervis records that his mind was made up in regard to the form of this truck in the summer of 1830, although he had no opportunity to construct an engine of that plan until 1832, when the first engine having one pair of drivers and a four-wheeled truck, manufactured by the West Point Foundry Association, was run on the Mohawk and Hudson Railroad, by David Mathews, till a speed of fifty miles per hour was attained.

*From the Transactions and Proceedings of the American Society of Civil Engineers, prepared by the following committee of the Society. Messrs. William P. Shinn, M. Am. Soc. C. E., and John Bogart, M. Am Soc. C. E.

An engraving in the *Railroad Gazette* for February 3d, 1872, shows the engine so designed in 1831. It is scarcely necessary to add that this precise form of truck is now in use on over 125,000 miles of railway in this country, as well as on many thousand miles in other countries. After the completion of the two railroads above mentioned, in 1833 Mr. Jervis was engaged by the Canal Commissioners as Chief Engineer of the Chenango Canal, 98 miles long, with 100 locks. On this canal, for the first time in this country, resort was had to artificial reservoirs for the supply of its summit level with water, and Mr. Jervis was the originator of the method. In 1835 the work of the enlargement of the Erie Canal was attempted, and Mr. Jervis was called upon to make surveys and estimates on the eastern section. He proposed corrections for many errors in its original construction, and at Little Falls he wholly rearranged the locks.

In October, 1836, he accepted the unsolicited offer of the position of Chief Engineer of the Croton Aqueduct, considered at the time of its completion as the greatest example in the world of hydraulic engineering skill. The difficulties with which Mr. Jervis had to contend, caused by the ignorance and sometimes by the malicious criticism of the opponents of the aqueduct, greatly tried his patience and skill, but he succeeded in holding the position until the work was completed; and it deserves to be here recorded, as an example for engineers, and for the contractors of public works of this day, that the aqueduct constructed to supply the then population of 250,000, with a view to ultimately supplying a population of 500,000, starting with the delivery of 12,000,000 gallons per 24 hours, is now supplying 95,000,000 gallons daily to a population of 1,400,000, and that the cost of the whole work, exclusive of the High Bridge, estimated by Mr. Jervis on January 2nd, 1838, at $8,464,033, was completed by a total expenditure to January 31st, 1848, of $8,766,626, an excess of cost over the original estimate of but $302,593, or about 3.7 per cent., which excess is almost entirely accounted for by the loss of the partially completed Croton dam on January 8th, 1841, and by the increased cost of land damages outside of which items we have the personal authority of Mr. Jervis for stating that the excess in cost over the original estimate was less than one per cent.

Mr. Jervis was appointed in 1846 Consulting Engineer on the Boston water supply, which position he held until 1848, during which time the Cochituate Water-works were located and partially constructed. The Water-works at Port Jervis, which place was named after Mr. Jervis by the directors of the Delaware and Hudson Canal Company, were constructed under his supervision, as were also the Rome Water works, in 1868. In 1847 Mr. Jervis was made Chief Engineer of the Hudson River Railroad, which position he held until 1849, and was Consulting Engineer until 1850. During his incumbency the Hudson River Railroad was completed from New York to Poughkeepsie, which included all the difficult portions of the work. The obtaining of capital for its construction was greatly facilitated by Mr. Jervis' well-known caution in recommending any scheme.

In 1850 Mr. Jervis went to Europe, where he spent four months, and was received with great honor on account of his engineering achievements. While there he was invited by Robert Stephenson to witness the launching of one of the large tubes for the bridge over the Menai Straits, of which he says: "the spectacle was highly interesting in itself, and was followed by an invitation to dine with a party of English Engineers, an occasion I enjoyed very much." On his return he engaged as Chief Engineer in the construction of the Michigan Southern and Northern Indiana Railroad, now the western portion of the Lake Shore and Michigan Southern, and then one of the most prominent public works of the country, about sixty-six miles of which, originally known as the Erie and Kalamazoo Railroad, had been constructed by the State of Michigan with a wooden rail and iron plates. Mr. Jervis continued his connection with this company until the spring of 1858. During the summer of 1851 he was made President of the Chicago and Rock Island Railway, which was constructed from Chicago to Davenport, 180 miles, and brought into use about 1854. From the spring of 1858 until the spring of 1861, Mr. Jervis was without professional engagement. In the fall of 1861 he was appointed General Superintendent of the Pittsburg, Fort Wayne and Chicago Railway, then just emerging from a condition of practical bankruptcy. The bondholders had foreclosed and sold the road, and the company had been re-organized, acknowledging, however, all classes of stockholders and creditors to the full amount of their original interest. The road had been cheaply constructed and inadequately maintained, and was in poor condition. The stock was then selling at 8 per cent., and not long after Mr. Jervis entered on the management a stockholder inquired of him if it would be advisable to sell at 20 per cent. He held the position of General Superintendent until March, 1864, when he resigned to take that of Chief Engineer, which position he occupied until 1866, and was Consulting Engineer of the company until 1872. During the period of his superintendence the track and machinery were greatly improved, the latter being very much increased in quantity, as well as improved in quality. During his administration all the fixed liabilities of the company were promptly met, and soon after his resignation as General Superintendent the company paid a semi-annual dividend of 5 per cent. The foundation was laid by Mr. Jervis for the extraordinary success with which the company's affairs have been so ably managed by his successors.

About 1872, Mr. Jervis was consulted by the parties who were contemplating the building of the Cazenovia and Canastota Railroad, who submitted to him an estimate which they had procured of the cost of building the proposed line asking his opinion thereof. With his usual caution and foresight, he recommended that they double the amount of the estimate, and not undertake the construction until they were prepared to expend the increased amount. This somewhat delayed the construction of the road, the cost of which, when completed, fully sustained Mr. Jervis' views. In 1868 he was made one of the first trustees in the organization of the Rome Merchant Iron Mill Company, which position he occupied until the time of his death. The operations of the company for the first two years resulted in serious loss, and threatened its bankruptcy; but in 1872 Mr. Jervis came to its rescue with a large loan of his personal funds, and assumed the position of secretary, which he held at the time of his death. Under his wise and prudent administration—for his was the keynote in the management—the company retrieved its former errors, and is now on a prosperous footing.

It will be seen, therefore, that for more than seventy years Mr. Jervis has been an active worker, and all his work has been of a character to leave an enduring impression on the country. Since his practical retirement from active railroad management, in 1866, he found time to write a book on "Railway Property," and another on "The Question of Labor and Capital." In 1877 he wrote a paper, published in the *International Review*, advocating the use of locomotives for towing boats on the Erie Canal—an unexampled evidence of progress at the age of evidence of progress of the age of eighty-two. In 1879, at the Young Men's Christian Association of Rome, Mr. Jervis wrote a lecture on "Industrial Economy," which was delivered before that Association. He was then past eighty-three years of age, yet that lecture showed his mind to be as clear, strong and vigorous as in the days of his prime. In 1878, Hamilton College conferred on him the degree of LL.D.

His last professional work, and that which most fully illustrates the extraordinary character of his professional ability, and the esteem in which he was held by his engineering contemporaries, was his employment as a Consulting Engineer, on the proposed new Croton Aqueduct, by the late Isaac Newton, Chief Engineer, and by Mr. E. S. Chesbrough, then Consulting Engineer for that work. Upon this business Mr. Jervis came to this city in December, 1881, and remained here some two weeks, consulting daily with Messrs. Newton and Chesbrough, and on his return to Rome he took with him various plans, and made a report substantially indorsing the plans proposed by Messrs. Newton and Chesbrough. That he should be equal to this work at the age of 86 was sufficiently remarkable, but that he should be considered as worthy of being consulted by men themselves veterans in the profession, is a still more extraordinary evidence of the exceptional character of the man.

Mr. Jervis' strongest trait was his absolute conscientiousness, exemplified in every walk of life. His career was an example of the most sterling integrity, and while he had many critics and opponents during his professional career, the tongue of slander never wagged against him. His life was a grand example to the young in all professions, and particularly to those of his own profession, who meet with so many temptations and discouragements; and a study of his memoirs, which will be published at length at an early day, will enable many a man to avoid the rock upon which so many barks have foundered.

His devotion to the good of his fellows is evidenced by his will, in which he bequeathed his valuable library and about one-third of his estate to erect a building for a library and lecture-room, for the use of the people of Rome, so long his place of residence.

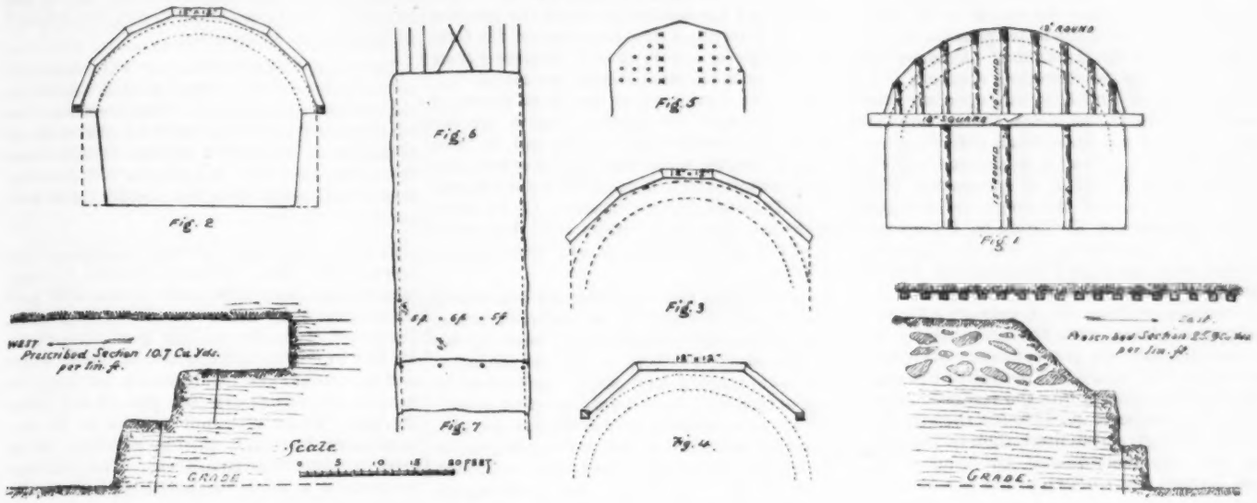
Mr. Jervis was twice married. In 1834 he married the daughter of the late George Brayton, of Weston, who died in 1839. Two years later he was married to Eliza R. Coates, who survives him. His health for the greater part of his life was remarkably good. During the past year his strength had been gradually failing, and he told one of the members of the committee at his last interview in November that his work was done. He had no special disease; the machine had simply worn out from old age. When one of the members of the committee talked with him, only two months before his death, his mind was as clear and his faculties as undimmed as at the beginning of their acquaintance, 24 years since, and it was only for a day or so before his death that mind and memory failed him.

In the death of John Bloomfield Jervis the whole community may truly mourn; for a great engineer, a good man, and a valuable citizen has departed. The important and enduring works on which he had spent a lifetime will elevate and benefit the human race long after his remains shall have crumbled to dust, and his fame as one of the greatest of American engineers will survive the age in which he lived. But above all, the remembrance of the industry, energy and perseverance by which he overcame all obstacles, and raised himself from the lowest to the highest rank in his profession, his purity of life and his honorable and high-minded character, will survive as an example and an incentive to the young men of America and encourage them to emulate his virtues.

Mr. Jervis became a Member of the American Society of Civil Engineers, December 4th, 1867. He was made an Honorary Member of the Society, December 2d, 1868.

No. 9.—LAUREL HILL TUNNEL—5th Division.

Continued from page 326



1. Laurel Hill, West.

2. Sandy Mountain limestone which drills and breaks up well but is a very tight rock in the center cuts.
3. The rock shows no regular stratification but appears to be horizontal where falls of top occur.
4. Three yards per lineal foot.
5. Center cut holes are from eight to ten in number, 5 feet apart horizontally, and 1½ feet vertically; and meet 6 feet from heading face.
6. 60 pounds ⅝ dynamite, varied in tight rock by loading bottom of holes with ⅛ dynamite.
7. 6 lineal feet is the average distance driven each 24 hours, one shift drilling and firing the cut, and the next shift working the side rounds.
8. 20 hours. $A = 14$ hours. $B = 2$ hours. $C = 4$ hours.
9. Usually placed 1¾ feet apart horizontally and 1½ feet vertically and drilled 8 feet deep; the number varies from 12 to 18, according to hardness of rock.
- 9¼. Cut and rounds drilled alternate shifts.
10. Varies from 36 to 54 pounds ⅝ dynamite average 7½ pounds per lineal foot of advance.
11. Heading 17½ pounds ⅝ dynamite per lineal foot.
    Bench 15 pounds " " " "
12. Force per lineal foot of tunnel:

HEADING.		BENCH.
0.33	Foreman	0.33
1.33	Power Drillers	0.67
1.33	Helpers	0.67
1.00	Muckers	2.67
0.33	Nippers	0.33

Force per 10 hours shift, not accounted for above:

General Foremen	0.50	Blacksmiths	1.00
Engineers	2.00	Helpers	1.00
Firemen	2.00	Dumpmen	2.00
Locomotive Drivers	1.00	Horses	2.00
	2.00		

13. See sketch—Columns 3 feet from face in heading.
14. See sketch—Bench worked in two lifts and trimmed with longitudinal side holes.
15. Per foot lineal of bottom:
    Yardage 8. Time 3½ hours. Holes 15.
    Explosives 15 pounds. ⅝ dynamite.
16. Temporary timbering shown in sketch No. 4 near portal where the only loose top was encountered.
17. Small size of heading causes inconvenience and delay in handling the machines, and the blasting of gothic top frequently loosens the rock on both sides so that it falls, or has to be removed afterwards. Insufficient capital for conducting the work and want of harmony between members of contracting firm.

1. Laurel Hill, East.

2. Bench in slate, heading in loose wet gravel containing boulders. This material extending upwards to ground surface.
3. Dips eastward 2°.
4. Varies from double track masonry section, near the portal, to a narrow gangway 7 feet × 6 feet, extending 336 feet from entrance.

5 to 11. The heading excavated with pick and bar.

12. Force employed on each ten hour shift.
    Heading, 2 foremen and 15 laborers.
    Bench, 1 " and 12 "
13. No machines used in tunnel.
14. The slate is drilled by hand, and light charges used on account of loose material above the timber supports. The excavation is for double track masonry section.
15. The bench progress depends on the advance made in overhead timbering. Last March the average was one day's time and 16 pounds No. 2 dynamite per lineal foot advance.
16. The first 60 feet of tunnel was supported on temporary longitudinal bars 15 feet long forming an arch supported at ends and centers by struts resting on transverse sills 7½ feet apart. (See sketch No. 1.) From a point 60 feet within portal the top is supported by temporary 7 block arches of timber (see sketch No. 2) resting on wall plates first placed by means of small side headings driven at the springing lines. Each arch is built up from the sides to the center. Distance between centers of these arches 2¼ feet.

    This style of heading also used without wall-plates (see sketch No. 3) at a detached point 200 feet within portal, where the slate rock is high enough to support the timbers securely. Here the arch was started from a central heading and built downwards.
17. Mining through and supporting loose wet gravel. Lack of capital for the proper prosecution of the work.

TO BE CONTINUED.

NEW ORDNANCE MATERIAL.*

Official Report to the U. S. War Department.

BY WM. H. BIXBY, CAPT. OF ENG'S., U. S. ARMY.

(*Continued from page 324.*)

Gruson Minimum-Embrasure Carriage (*Continued*).

Plates Nos. 7 and 8 show fully the general construction of this new carriage (*C*-1880) as applied to 6-inch and 11-inch guns. The only difference between these new carriages for the smaller guns and those for the larger guns, is that caused by the use of hand machinery alone, to work the hydraulic apparatus in the former, and by the use of a steam engine to work the same apparatus in the latter. In the small carriages all the apparatus is attached rigidly to the carriage, and is carried by it; in the larger carriages for 28-c. m. (11.0 inch) and larger guns, it is necessary to make use of a flexible or sliding tube, or a tube with flexible or sliding joints, connecting the carriage to the accumulator below.

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The usual arrangement of the carriage and apparatus is as follows:—

The gun turns freely on its trunnion-beds; these trunnion-beds move in circular slots within the cheeks of the upper carriage, and they are connected together by a strong U-shaped cross-girder passing beneath the gun; this cross-girder is constantly supported by the piston of a hydraulic press placed beneath the gun and attached firmly to the upper carriage; the upper carriage rests upon a chassis of the ordinary form of construction; during the gun's recoil the upper carriage, together with the hydraulic press, rolls upward to the rear in the ordinary way; at each end of their course the carriage rollers descend into shallow mortises in the upper surface of the chassis rails, and the upper carriage no longer rolls but slides upon its chassis; the recoil of the gun and carriage, and all motion of the carriage, is controlled by hydraulic buffers firmly attached to the exterior of the chassis rails, the buffers being so adjusted as to nearly but not quite stop the motion of the carriage before the latter ceases to roll and commences to slide upon the chassis rails; metal spring buffers on the inner sides of the chassis rails destroy any final jar.

The carriage mechanism is self-acting, so that the gun not only recoils but comes down again into battery without the need of any attention from the gunners.

P is the pivot of the wrought-iron guide-bar *F F'* which moves through T-shaped slots in the collars *R* and *R'*, attached firmly to the gun. In the latter model Krupp guns, these collars are replaced by projecting pieces built into the under side of the gun.

The trunnions of the gun are lifted by hydraulic power, furnished either by hand pumps (or better, for the large guns, by a small 3-cylinder 12-horse-power machine), and an accumulator. The liquid employed is generally glycerine.

The piston *S* is surrounded by an annular cylindrical space *D*, so that it can receive a downward pressure upon the small annular surface, just above *K*, by liquid entering the

space D through the tube L; the piston S can also receive a great upward pressure on the whole surface of its lower head, by liquid entering through the tube L' into the space below K. The upward pressure is arranged to be a little greater than the weight of the gun, and a little less than the latter plus the downward pressure of the liquid in D. A movement of the lever A, in one direction, connects L' to the accumulator and L to the open air; the liquid enters by L', the piston S rises, and the liquid in D runs out into a small collecting reservoir. A movement of A, in the other direction, puts both L and L' in connection with the accumulator, and the weight of the gun plus the pressure of the liquid in D becomes greater than the pressure below the piston S; S sinks; and the liquid beneath S is forced through L' back into the accumulator. An intermediate position of A cuts off all communication, either with the accumulator or the open air, and the gun remains stationary. One complete up-and-down motion of the gun, thus causes the escape into the reservoir of as much glycerine as it takes to fill the annular space D; this glycerine must then be pumped back into the accumulator by hand or by steam power; but such pumping can be done either uninterruptedly, or at any moment which is convenient to the workmen or machine.

Mr. Gruson always tests his carriages by firing six or ten trial-shots with the gun for which the carriage is constructed. He is ready to manufacture such carriages for any size of gun, up to the largest gun yet made, and he will guarantee a perfect working of the carriage.

The accompanying table* gives all details as to the time of manoeuvre and weight of the carriage, and the dimensions of the throat of the embrasure required for turret guns of calibers from 12.c-m. (4.7-inch) to 30.5-c.m. (12.0-inch) inclusive.

Cannon.			No. of men needed to elevate the gun		Range of fire.		Maximum interval of time to			Shortest time.	Carriage.	Embrasure at its throat.	
Dimensions.		Weight.					raise the gun.		lower the gun.				
Caliber.	Length in Calibers.		By Hand Pump.	By Accumulator.	Elevation.	Depression.	By Hand Pump.	By Accumulator.	From Maximum Elevation to Maximum Depression.	Between Shots.	Weight	Height.	Breadth.
In.	Cal.	Tons.	No.	No.	°	°	Min	Min	Min.	Min.	Tons.	In.	
4.7	26.6	1.7	2	—	25	10	0.8	—	0.3	1.0 to 1.5	4.4	13	
5.9	24.	3.2	3	—	25	10	1.2	—	0.5	1.0 to 1.5	6.7	15	
8.3	30.	10.8	4	1	12	6	4.	2.5	2.5	2.0 to 3.0	11.7	19	
9.4	30.	17.5	5	1	12	6	7.	2.5	2.5	2.0 to 3.0	18.5	21	
11.0	33.	36.4	6	1	12	6	13.5	2.5	2.5	2.5 to 3.5	29.3	26	
12.0	25.	37.5	6	1	12	6	13.5	2.5	2.5	2.5 to 3.5	28.2	27	2 inches more than the exterior diameter of the gun at the embrasure.

Breech-loading guns, mounted in Gruson turrets, should have the gun project at all times at least 30-c. m. (11 inches) outside of and beyond the front surface of the turret.

By this arrangement of gun and embrasure, the pointsman standing on the front part of the carriage, and using sights on the chase of the gun, can obtain a field of view of about two degrees, in all positions of the gun.

The minimum embrasure of the cupola in construction for Helder, measured on the outside 1.60 metres (63 inches) in height, 0.90 metres (35 inches) in width; and at its throat 0.70 metres (28 inches) in height, and 0.70 metres (28 inches) in width. This embrasure was for the 30. 5-c. m. (11-inch) gun, whose diameter was 60-c. m. (24 inches) at the embrasure.

The minimum-embrasure of the cupolas in construction for Pola measured at its throat 0.69 metres (27 inches) in height, and 0.66 metres (26 inches) in breadth, for 28-c. m. (11-inch) guns; this allows two inches spare room all around the outside of the chase of the gun.

Captain Piorkowski (Mr. Gruson's representative) regarded the new Gruson muzzle-pivoting-gun gun-carriage, as permitting almost as rapid work as the Krupp gun-casemate gun:—

Firstly; on account of the solidity of the carriage and the method in which the gun was allowed to recoil, a gun mounted on the Gruson carriage is hardly at all disturbed from its position in traverse, during its recoil.

Secondly; by the use of the small rollers of the carriage and the mortises cut in the top surface of the ends of the chassis rail, the gun comes back after recoil into almost exactly the same position which it occupied before firing.

Thirdly; owing to the position of its pivot and the use of its front guide bar, the elevation of the gun is hardly if any deranged by the firing.

Fourthly; the use of graduated horizontal arcs with black numbers on polished brass, placed where they can be readily seen by the servants, make it extremely easy for the latter to correct quickly any slight deviations in traverse that may have been caused by recoil.

Fifthly; the vertical graduated arc for giving elevations, is placed where it can be readily seen by the pointsman; and this combined with the easily manoeuvred hydraulic apparatus, makes it possible for the pointsman, assisted by the servant of the piece, to quickly correct or change the elevation if necessary.

Disappearing-gun gun-carriages.

No disappearing-gun gun-carriages, or "disappearing-carriages"[1] as they are generally termed, have yet met with decided favor in Europe. The objections to all models so far proposed are, that they are either too complicated and too costly, or require complicated accessories and costly foundations; that they can be easily deranged by the effects of shot striking near the crest of the front parapet; that the gun in its lowered position is too far away from the crest of the parapet to give the requisite protection against descending shots; and finally that even with a perfect disappearing carriage the servants are still exposed to decending cannister, grape, shrapnel, and to the fragments of exploding shot and shell.

The disappearing carriages which seem to have so far met with the greatest favor in Europe are the Moncrieff and King counterpoise carriages, the Moncrieff hydro-pneumatic carriages, the Labrousse, Armstrong, and Razkazoff carriages, using either Belleville disc springs or hydraulic machinery, or both. In the first four of these carriages the force of recoil is utilized to return the gun to its firing position; in the last two the gun must be raised by the direct application of power from without.

The *Moncrieff counterpoise carriage* is so well known that it needs no description.[2] In 1870 it was proposed to use 172 of those carriages for 9-inch and 10-inch guns for the sea coast defense of England; but up to 1881 only two 9-inch guns and not very many 7-inch guns had been so mounted.

The *King disappearing* or "depressing" *counterpoise carriage* is also so well known as not to need description.[3] This carriage has been tested from 1869 to 1873 by 163 shots at all angles of fire from 3 degrees depression to 30 degrees elevation, and always with satisfactory results even when the chassis rails were covered with ice.[4]

The *Moncrieff hydro-pneumatic disappearing carriage* has been officially adopted by England for six 6-inch rifled guns; it has also been used successfully with 8-inch rifled howitzers. The recoil of the descending gun compresses air in a buffer containing also a little water and glycerine; the compressed air supplies enough force to return the gun to the firing position. There does not appear to be any immediate prospect of this carriage being used for guns of large calibers. The carriage needs to be securely anchored both vertically and horizontally.[5]

The *Labrousse disappearing carriage* is a modification of the Moncrieff carriage proposed by Admiral Labrousse, French Marines, in 1869. In this carriage, the recoil of the descending gun compresses a long buffer made up of Belleville steel discs; the compressed discs supply enough force to return the gun to the firing position. The carriage seems to have given successful results for guns of less caliber than the 8-inch; but there does not seem to be any immediate prospect of its use for larger guns.

The "*Armstrong*" or "Elswick," or "Rendel" *disappearing carriage* is a modification of the Moncrieff carriage in which the counterpoise is replaced by a hydraulic buffer. The recoil of the descending gun is merely resisted by the hydraulic buffer, and no attempt is made to utilize the recoil for returning the gun to its firing position. The gun is raised by the use of direct hydraulic pressure, provided by either steam or manual power and hydraulic pumps. This carriage has been successfully applied to the 11-inch 25-ton R. M.—L. guns of the Temeraire; the hydraulic plungers in this case have a direct motion of only about 12-inches. There does not seem to be any reason why this system should not be applicable to the largest guns. When combined with a revolving roofed platform behind a fixed armored barbette tower as in the Temeraire it gives complete protection to the gunners.[6]

The *Razkazoff disappearing carriage* is a further modification of Armstrong's modification of the Moncrieff disappearing carriage. In this form of carriage, Belleville discs springs are used to vary and regulate the hydraulic pressures during the de-

*The original outline of this table was drawn up by the writer in person at Magdeburg, in 1881, and the dimensions were then filled in by Mr. Gruson at the writer's special request.

[1]The term "depressing-carriage" is sometimes used in the United States with the same signification as "disappearing-carriage," but throughout Europe the term "depressing-carriage" is limited to mean a carriage which allows a gun to be fired under great angles of depression.

[2]For full details; see Moncrieff and English as quoted under Bibliography; also, pages 157 to 166, Treatise on Military Carriages, London, 1879. For excellent plate and short description; see article "Gunnery" in 9th edition of Encyclopedia Brittanica. See also page 54 and plate 6, Vol. 7, Prof. Papers Ryl. Engrs., for 1882.

[3]See King, Counterpoise gun-carriages, 1869; also pages 40 to 46 (2 plates) U. S. Ord. Notes, No. 16; also, Clavarino, pages 619 to 622, Vol. 2, Corso di Artiglieria.

[4]See official reports of U. S. Committee on tests of 1873 of the King carriage, quoted in full by Revue Maritime et Coloniale, and given also by Clavarino, page 622.

[5]For full details; see Rendel, pages 160, 104, 107, 117, 130, 134 and Fig. 1, page 134, Vol. 38, Proceedings Inst. of Civil Engrs., England, 1874; also, Clavarino, pages 625, Fig. 655, Vol. 2, Corso di Artiglieria, Turin, 1878; also, Lewis, pages 56 and 57, Vol. 7, Prof. Papers Royal Engineers, for 1882; also articles of Moncrieff and English as quoted under Bibliography.

[6]For further details; see Rendel, page 101, 139 and Fig. 26 vol. 38, Proceedings Institution Civil Engineers England 1873-4; also Clavarino, pages 640 to 642, and Fig. 659, vol. 2, Corso di Artiglieria.

scent and rise of the gun. No attempt is made to utilize the recoil for returning the gun to its firing position; but the gun must be raised by the use of direct hydraulic pressure produced by either steam or manual power and hydraulic pumps. These carriages have been successfully applied to the two 12-inch 40-ton R. B.-L. guns of the Admiral Popoff barbette towers. There seems to be no reason why these carriages should not be applied to even larger guns.

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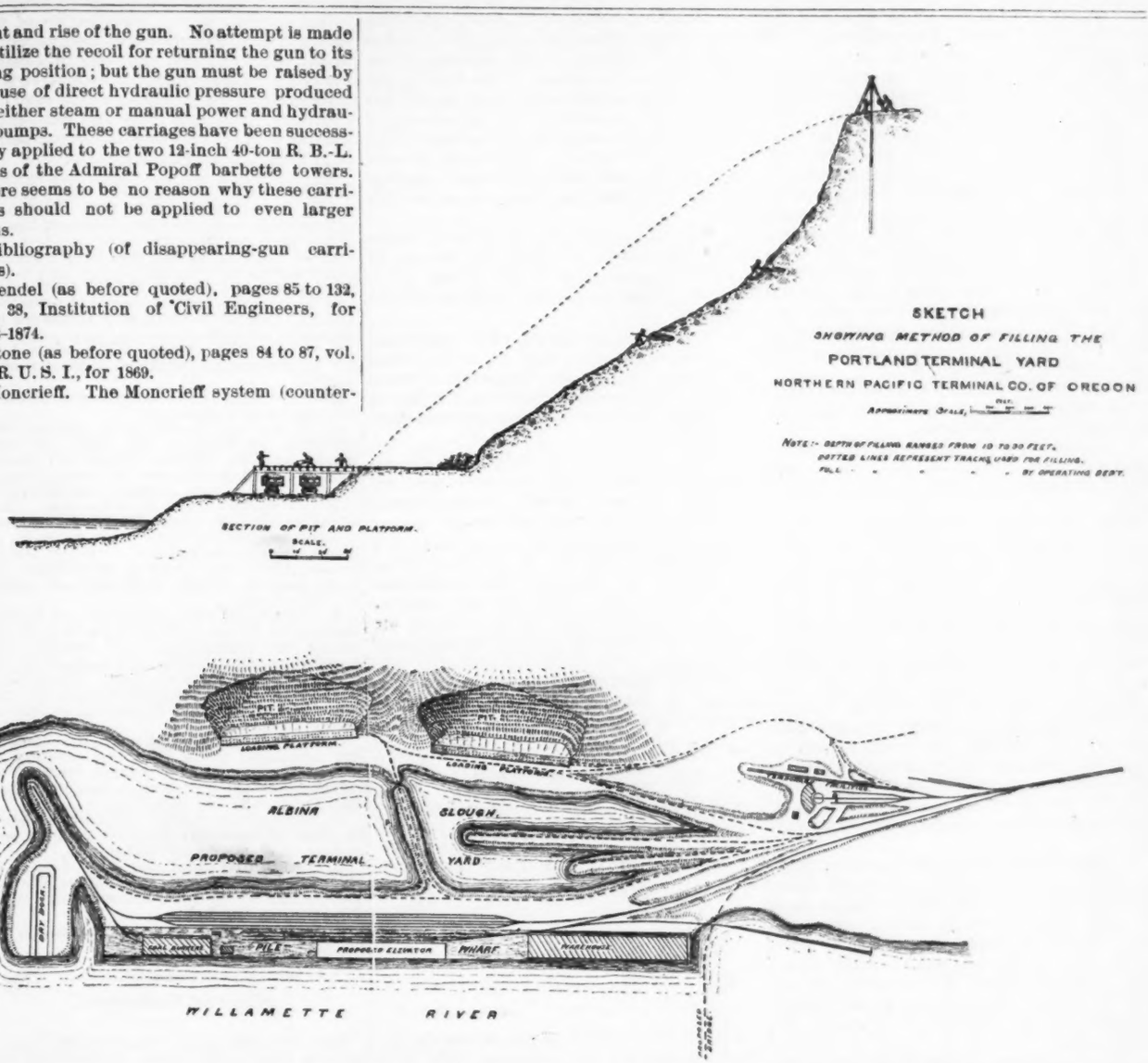
TO BE CONTINUED.



Borrow-Pit Excavation at Portland, Oregon.

Written for ENGINEERING NEWS.

BY GEORGE B. FRANCIS, C. E.

Perhaps some of your readers will be interested in the following description of a method of borrow-pit excavation, which was used in obtaining material for filling the terminal yard of the Northern Pacific Terminal Co., at Portland, Oregon, during the summer of 1883, putting the record of steam shovels in the shade, so far as rapidity of excavation is concerned.

This yard is destined for the use of the Northern Pacific R. R., the Oregon and California R. R., and the Oregon Railway and Navigation Co., jointly.

It is to contain a full set of construction shops and all other modern requirements for a first class terminal yard in every respect.

It is fully a mile long and 1300 feet wide and was laid out partly on ground submerged at high water and partly on ground submerged at all stages of water, or, as it is termed in that locality, it was laid out in a "slough." Nearly the entire area called for a fill of from 10 to 20 feet, to bring it to the proper grade.

The portions of the yard which were immediately necessary for the use of the operating department, were filled first, which necessarily caused the work to be done not in the most economical manner possible, considering the yard as a whole.

The borrow-pits were in the face of a bluff which rose out of the slough in the rear of the yard. The material was loam and sand. The loam was on top and was baked quite hard during the dry season.

The contract called for moving about 1,200,000 cubic yards and an output of of 125,000 cubic yards per month, from a pit whose face did not exceed 2,000 feet in length. There was not room to arrange tracks for using more than two steam shovels, and as 30,000 cubic yards per month was all that one steam shovel had been able to accomplish, the project of using them had to be abandoned and a better one substituted, to enable the contractors to move the required amount, without resorting to night work.

Two platforms, each about 700 feet long and forty feet wide, were built parallel with and close at the foot of the bluff. Each platform covered two standard gauge tracks and was high enough to allow the dump cars to run under it. This made four tracks each 700 feet long for loading room. Holes about 20 inches square were cut in the platforms, over each track, to fit the car bodies. By this arrangement one train of cars could be loading while the other was being dumped and only one locomotive and train crew would be required, for each platform. This locomotive was kept continually on the move.

The material was loosened by confining Judson powder in holes excavated in the slope and on top. When exploded this carried a large amount of loose earth down the slope on to the back edge of the platforms.

On one platform about six hundred Chinamen with wheelbarrows were continually moving the earth from the foot of the slope and dumping it through the holes into the cars.

The foreman was careful to see that the empty train was long enough in returning to allow the Chinamen a fraction of a moment's rest between trains. The Chinamen worked hard in their endeavor to make this fraction as large as possible, but somehow it never was but about so long, no matter how hard they worked. The prospect of a few seconds

rest seemed to stimulate every man, and the pigtails fairly jumped. I doubt if they ever worked better in any instance.

On the other platform horses and scrapers were used instead of wheelbarrows. One way was about as effectual as the other and at nearly the same cost. The effect of the competition between the two platforms, and methods, kept the price of teams and labor at a low figure. The teamsters were all white men, and owing to the scant supply of teams in the vicinity would have surely demanded higher wages, if they had believed the contractor had to depend on them, and Chinamen are not averse to demanding higher wages if they enjoy a monopoly. This the contractor knew, and considered it best to continue using both methods, even though one was a trifle more expensive than the other.

At first some of the horses would step in the holes, but soon learned to straddle them as intelligently as a Chinaman.

The cars were ordinary flat-cars with three side dumping-boxes placed upon them. The length of haul averaged about four thousand feet.

During the month of July, when the work was well under way, 153,000 cubic yards were moved, and during the month of August, when the largest output was made, 183,000 cubic yards were moved. This included a small amount of material from trimming slopes in railroad excavation near by. The material was measured each month in the pit and in the fill, also checked by car loads. The first month when the earth was partially dumped into water, the shrinkage between pit and bank measurement was 10%, the second month, on the total to date, it was 8.8%, and on a total of 418,000 cubic yards (which was not the final estimate) the shrinkage was 3.4%. The bank had probably not become fully settled at this time.

The bank measurement was made by scaling plotted areas of cross-sections and was a close approximation, but was not made with the same care as the pit measurement, on which the payments to the contractor were based. The check by car loads was fairly uniform. The first month the pit measurement made 6.0 yards per flat car, the second month 6.2 yards per car and the third month 5.9 yards per car.

A little more than one half of the whole contract was executed when the panic struck President Villard and work was suspended. The accompanying sketches illustrate more clearly the method used.

Rail-Testing in Russia.*

BY N. BELELUBSKY.

(Wochenschrift des österreichischen Ingenieur-und Architekten-Vereins, June 6th, 1885, p. 223.)

Since 1878 the Russian Ministry of Ways and Communications has enforced the following conditions for the testing of iron and steel rails.

The whole supply of rails is first to be inspected and their dimensions checked. After the removal of defective rails the rest are to be piled in stacks of 1,000 each. From each of these stacks the Government inspector is to choose three rails, from each of which three test pieces 6-feet in length are to be carefully cut.

Of the three test pieces one is to be subjected to a pressure test and the other two to a striking test. If the testing takes place at a higher temperature than from 0° to 10° Fahrenheit, two at least of the pieces must undergo the striking test reduced to that temperature. The cooling is done by surrounding the rail in a wooden box, 9 feet 4 inches by 3 feet by 2 feet, with a mixture of ice and salt. The temperature of the rail is measured by a thermometer, placed in a hole bored in the end of the rail and filled with mercury.

* From "Abstracts" of the Institution of Civil Engineers.

1. *Test for Bending under Load.*—The piece to be tested is laid on supports 3 feet 6 inches apart, and subjected for five minutes to the application in the middle of the load A (see Table), when the deflection must be not less than 0.12 inch (3 millimetres) on removal of the load, but the permanent set not more than 0.08 inch (2 millimetres). The weight is to be applied twice, and after the second application the permanent set must not exceed 0.08 inch.

2. *Bending Test with Increased Load.*—Pieces which have stood the first test are to be subjected to the load B (see Table), which they must support for five minutes without breaking.

3. *Test by Falling Weight.*—The remaining two pieces of the same rails are to be placed on the supports, and after two strokes from a weight of 923.7 pounds falling from a height H (see Table), must not show any external signs of fracture.

4. *Test of the Goodness of the Material.*—All pieces which have stood the above tests are put under the same hammer, falling from H + 1, H + 2, etc., feet until they break.

NOTE.—The testing apparatus is made to a normal pattern, and the site for its erection is chosen by the inspector. The metal base must weigh not less than 19.7 tons, and the bottom of the stone foundations must be not less than 4 feet 6 inches below the surface of the ground.

The following Table gives the values of A, B, and H, referred to above, for various weights of normal steel and iron rails:—

	Weight per yard	Load A.	Load B.	Height H.
	Lbs.	Tons.	Tons.	Feet.
Steel	46.4	9.00	13.92	4.75
	50.4	11.06	16.38	5.65
	54.4	13.10	19.66	6.50
	58.5	15.15	22.52	7.50
	61.5	17.20	25.39	8.50
Wrought Iron	51.4	9.00	11.47	4.00
	54.4	11.06	13.51	4.55
	61.5	13.10	16.38	5.25
	70.6	15.15	20.07	6.00

If more than a third of the pieces do not stand the tests all the thousand rails from which they have been taken are rejected, but if a third, or less than a third fail, it is permitted to redivide the stack of one thousand into lots of two hundred to three hundred, and make the acceptance of these depend upon the tests of at least two rails from each stack.

The putting aside of large quantities of steel rails from year to year, in consequence of breakage or wearing out, suggested to the Imperial Russian Technical Society in St. Petersburg to contribute, by examination of the removed rails, to the discovery of the causes which influence the life of rails; and especially with a view to finding whether the present testing regulations require alteration, and whether harder or softer material is to be preferred for rails. To forward these investigations nearly all the Russian railways sent to the Technical Society a large number of samples of rails and tires, with statistical notes referring to each. Although these investigations were commenced by the Technical Society as a private undertaking (with, however, the support of the railway management), the work received official recognition in 1884 from the Ministry of Ways and Communications, and the convention of representatives of steel-works and of railway managers called together by this Ministry decided to defer until the conclusion of the first series of investigations the answering of the question whether the regulations for testing and accepting rails which have been in force for the last seven years required to be altered or not? This first series consists in the examination of worn rails and tires. The results will be put together in the graphic form, and will probably be ready by January 1886. A further series of investigations is planned, in which steel rails of different degrees of hardness, furnished by Russian steel works, will be laid in and periodically inspected by the commission.

The following are the alterations in the regulations for the acceptance of rails suggested by the Management of the State Railways in conjunction with the Commission of the Imperial Technical Society.

1. In the bending test with load A the maximum permanent set shall be 0.04 inch (1 millimetre), instead of 0.08 inch (2 millimetres), and no demand need be made as to elasticity.

2. The test for bending with increased load B may be omitted.

3. If the temperature of the air is below 9.5° Fahrenheit, no artificial cooling need be applied.

The following is the programme of the investigation now going on:—

A. Data to be collected by the railway management: (*a*) Type of rail, name of works, mark and year, original weight per running foot. (*b*) Load on the axles of engines running upon the line. Gross tonnage passing over the rails. (*c*) Weight of rail when taken up. Cause of failure: broken (time, place, on or between the cross-sleepers); not broken but worn out. (*d*) Position of the rail in the line: in straight or on curve (radius, inner or outer line), level or on gradient, quality of ground and ballast. (*e*) Life of rail.

B. Ministerial tests: Striking and bending, carried out by the Commission at the Putiloff works (St. Petersburg). (*a*) Bending test: loading in press; deflection permanent and temporary. (*b*) Striking test: Temperature of the tested rail; height of fall of the monkey (1½ ton in weight). Deflection at first and second blow.

C. Tearing test, carried out in the mechanical laboratory of the Road-Construction Engineers Institution. (*a*) Tensile strength (R), relative extension (*i*), contraction (*c*) at fracture. Product R*i* and sum R+*c*.

D. Torsion test, carried out at same place as C. Limit of elasticity, shearing strength, work at limit of elasticity and at fracture.

E. Quantitative analysis, carried out in the chemical laboratory of the Finance Minister. Percentage of Carbon, Manganese, Silicon, Phosphorus, Sulphur.

Graphic representations of the results will be drawn up.

Municipal Engineering.

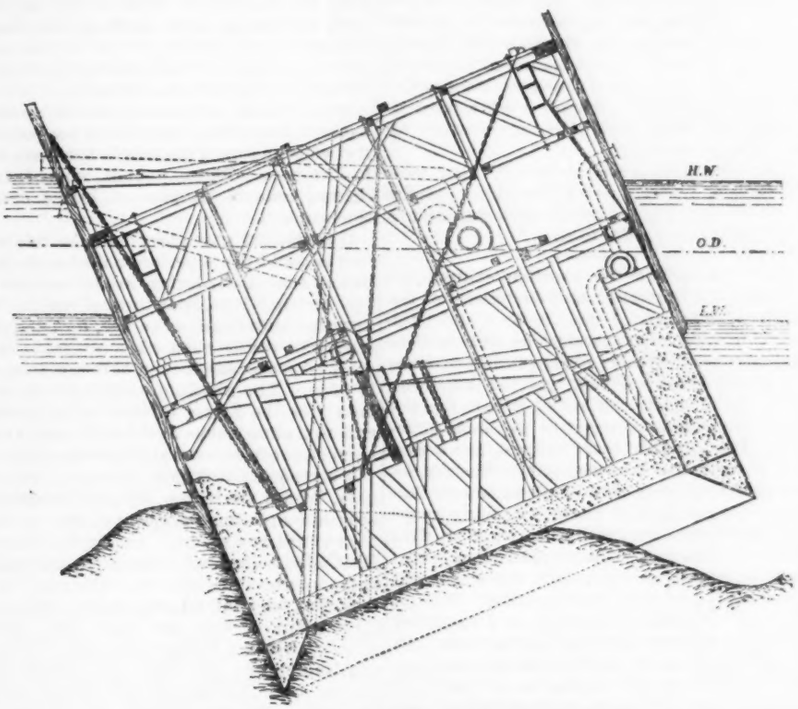
Our esteemed and enterprising contemporary, *Engineering News*, of New York City, announces as part of its programme for the coming season, a series of specially prepared papers upon city engineering, which will include, with illustrations, the latest *actual practice* in this line in each of the more important cities of the east. It is prepared to give the practice as it is found, the bad as well as the good, with such remarks and examples as will show why it is either the one or the other in a given case under consideration. The field to be covered is outlined as follows: "The area, population and location of the city to be described; its water supply, sewage system, rainfall, frost penetration, geological and topographical features, etc.: the organization of all departments having control of public works, with their duties; the various systems of street paving, side walks, street cleaning and watering, street lighting, etc.; the regulations controlling all sewer, water and gas connections, with fees; the opening of new streets; control of contractors, street railways, and telegraph wires."

A complete compilation of such matter, with good, practical suggestions as to faults and abuses, wedged in where they properly belong, will be of untold value to every community, and worth more than a hundred books on this subject which give theory without practice.

A model city must be judged, in great part, by the character of its public works. Where these are faulty, numerous other evils and annoyances follow that cost vast outlays of time and money to remedy which might have been saved if good judgment had been used and practical experience employed at the start. If the *News* carries out its programme as contemplated, the old engineer as well as the new will have example and experience before him such as only much outlay of time and money can otherwise secure. The projectors of this enterprise should be well repaid for their labor by a large increase of subscribers during the winter months. *North Western Architect and Improvement Record.*

The Forth Bridge.

It will be remembered that during the last winter a mishap occurred to the large caisson which will occupy the north-western corner of the Queensferry main pier of the Forth Bridge. It had been launched, and towed successfully into position, but some short time afterwards it became flooded, and partially sank, sliding forward at the same time until it took up a tilted position in the bed of the river. The displacement was about 15 feet, and the angle of slope 25 degrees. To remove this enormous mass, which weighs about 4,000 tons, and is 70 feet in diameter, has been a work of considerable difficulty. At first it was thought that it could be raised by adding plating to the submerged side until it was clear of the water, and, after the interior had been properly strutted, by pumping out the water, it was hoped that the caisson would be floated. This method, however, did not prove successful, as, in the course of pumping out the caisson, it gave way in a weak place. It was then determined to encase the caisson in a complete system of timbering, while the interior was carefully strutted throughout. When this had been completed, the water was pumped out, and the caisson floated. Owing to its tilted position, not only was the work of surrounding it with timber tubbing rendered very difficult, but the stresses on the strutting were much exaggerated. The determination of the stress involved problems of some intricacy, but the engineers left nothing to chance, but met every stress by a strut or tie of adequate strength. It was impossible to predict whether the caisson would gradually right itself as the water was pumped out, or whether the "stickage" of the mud filling the "working chamber" at the bottom would prevent the hydrostatic head taking effect upon the caisson till all the water was pumped out. It was necessary, therefore, to provide for the worst condition, and this implied an unbalanced pressure of 1,240 tons taking effect on the northern or deepest side of the caisson. To resist this a circular steel girder, with four raking steel struts, was provided, besides strong timber struts and chains as shown in the engraving above. The timber sheathing consisted of whole balks bevelled into each other, with strips of felt at the joints. To make a water-tight joint with the ironwork, recourse was had to grouting, oakum, and sailcloth. Two 18-inch Gwynne pumps fixed at different levels effectually dealt with the water inside the caisson, and a 12-inch mud-pump and Batho dredger removed enough of the bank on the south side to form a fairly level bed for the caisson when floated again into position. It proved that the tendency of the caisson was to right itself inch by inch daily if the water were kept some feet lower inside than outside. By encouraging this tendency its position was materially improved before the final operation of pumping out and floating took place. The designing and carrying out of the operations for raising the sunken caisson was the joint work of Messrs. Fowler and Baker, the engineers, and Mr. Phillips, one of the contractors. Great credit is due to the foremen and workmen employed, and especially to the divers who had to fix all the tubbing and heavy steel strutting, piece by piece beneath the chilly waters of the Forth.—*Engineering.*



FORTH BRIDGE; THE TILTED CAISSON.

Two New "Print" Processes on White Ground.

A new process known as "Shawcross's patent sensitized paper," the lines of which are black and the background white, has recently been introduced in England, in which the manipulation is exactly similar to the ferro-prussiate process. Mr. Shawcross's sensitized paper is originally of a bright yellow color and possesses the following properties: If immersed in water the paper rapidly turns black, or if first exposed to direct sunlight it is bleached and assumes a pure white face, after which water has no effect upon it. From a statement of those two properties the method of manipulation in order to produce a copy of a tracing can readily be conjectured. All that is necessary is to place the tracing (which should be on a pure white or bluish shade paper) on the top of a piece of sensitized paper, taking care that no creases exist and that contact between the two is perfect over all the surface. Then by exposing the whole to the light that portion of the prepared surface immediately underneath the lines of the tracing remains unaffected, while the whole of the remainder is bleached, so that when the process is complete we have an exact copy of the tracing in yellow. These lines will immediately turn black when the paper is immersed in water, giving the desired copy. The usual precautions must be observed in working with the paper, viz., not to expose it unnecessarily to the light, to immerse the yellow tracing first in still water, and afterward wash thoroughly in relays of clean water to complete the print. If these cautions are observed, a clear and distinct copy of the original will be produced. The operation is facilitated by using a printing frame and a piece of felt on the back of the paper to give a uniform pressure while being exposed to the light. Thus the process is a direct positive one, and produces *fac-simile* copies of the tracings by the very simple operations of exposing to light and washing in water, no chemical baths being required. The paper is sold in rolls of eleven yards long and twenty-nine inches wide, by George J. Poore & Co., stationers, Castle street, Liverpool.

Mr. A. H. Haig has described, at a meeting of the Engineers' Club of Philadelphia, the following process for making photographic copies of drawings in blue line on white background, which was invented by H. Pellet, and is based on the property of perchloride of iron of being converted into protochloride on exposure to light. Prussiate of potash, when brought into contact with the perchloride of iron, immediately turns the latter blue, but it does not affect the protochloride. A bath is first prepared consisting of ten parts perchloride of iron, five parts oxalic or some other vegetable acid and 100 parts water. Should the paper to be used not be sufficiently sized, dextrine, gelatine, isinglass or some similar substance must be added to the solution. The paper is sensitized by dipping in this solution and then dried in the dark, and may be kept for some length of time. To take a copy of a drawing made on cloth or transparent paper, it is laid on a sheet of the sensitive paper and exposed to light in a printing frame or under a sheet of glass. The length of exposure varies with the state of the weather from fifteen to thirty seconds in summer, to from forty to seventy seconds in winter, in full sunlight. In the shade, in clear weather, two to six minutes, and in cloudy weather, fifteen to forty minutes may be necessary. The printing may also be done by electric light. The print is now immersed in a bath consisting of fifteen to eighteen parts of prussiate of potash per 100 parts of water. Those parts protected from the light by the lines of the drawing immediately turn blue, while the rest of the paper, where the coating has been converted into protochloride by the effects of light, will remain white. Next the image is freely washed in water and then passed through a bath consisting of eight to ten parts of hydrochloric acid to 100 parts of water, for the purpose of removing protoxide of iron salt. It is now again washed well in clean water and finally dried, when the drawing will appear in blue on a white background.

MINUTE SCREWS.—A newspaper correspondent describes the American watch manufactory at Waltham, Mass., and in speaking of the astonishing minuteness of some very essential parts of the watch says: "A small heap of grain was shown to us, looking like iron fillings or grains of pepper from a pepper caster—apparently the mere dust of the machine which turned them out—and these, when examined with a microscope, were seen to be perfect screws, each to be driven to its place with a screw-driver. It is one of the statistics at Waltham worth remembering that a single pound of steel, costing but 50 cents, is thus manufactured into 100,000 screws, which are worth $11.

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CLUBBING ARRANGEMENTS.

1886.

The "subscription season" for the most popular American Magazines is close at hand, and inquiries as to our proposed clubbing arrangements are being made. We beg leave to announce, therefore, that on and after JANUARY 1, 1886, the subscription price of ENGINEERING NEWS will be **$5.00** per year; until that date the price and clubbing rates with other publications will remain as given below.

We are now planning such improvements in ENGINEERING NEWS, and negotiating for special work to be done during the coming year, as will cost double any possible increase of income from subscriptions; the long notice of change which we here give enables nearly, if not all, present subscribers to renew at present rates. We intend eventually to publish a class journal which will acknowledge no superior in the world, and we feel so confident of the support of our present patrons that we have no hesitation in venturing on the greatly increased expense necessary to carry out our programme.

If an English engineering journal, carrying fifty pages of advertisements and twenty four of reading matter sells for $10, why may not an American journal of equal merit sell for at least half as much.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer he following terms until January 1, 1886: We will send to any address ENGINEERING NEWS at regular subscription price, **$4.00** and the following at the additional prices given:

	Net. Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
Harper's Bazar	3.25	4.00
Harper's Young People (weekly)	1.65	2.00
Popular Science Monthly	4.25	5.00
St. Nicholas Magazine	2.55	3.00
North American Review	4.10	5.00
Cassell's Magazine of Art	m 3.00	3.50
Cassell's Family Magazine	m 1.25	1.50

The Century Magazine commences its year with the November Number; Harper's Magazine commences with the December Number. Subscribers should renew these Magazines in October and November.

TO SUBSCRIBERS.

The date of expiration of subscriptions is given on the printed address-lable attached to each copy of this paper, and is, we trust, a sufficient notice to all parties proposing to renew for the ensuing year.

THE proposed London-American Exhibition of 1886 is still alive, though the press of this country seems to ignore the fact, and the Exhibition's own organ is provokingly silent as to any material progress made. In the selection of Mr. Henry Sturgis Russell, of Boston, as their Vice-President, the Executive Council of the Exhibition display wisdom, and bid high for the support of New England in their undertaking. Mr. Speed, the new Secretary, is also an energetic worker, and will doubtless add strength to the organization.

We have already expressed our faith in the benefits to American manufacturers to be derived from a properly conducted exhibit in England, of our machinery, tools, and finished products. The Centennial Exhibition of 1876 has accomplished in a decade an advance that in equivalent in rate to a half-century of previous progress, and its influence is apparent in every direction. An exhibition in London of what we have done in these ten years, and what huge proportions the capabilities of this country can assume, cannot fail to attract renewed attention, and widen the demand for our goods.

But time passes, and we should hear from those best posted, just what the prospects are for carrying this important undertaking to a thoroughly successful issue.

NOTWITHSTANDING the excellent example set by the Civil Engineers and Surveyors of the States of Michigan, Ohio, Indiana, and Missouri, in organizing associations and publishing some very valuable papers and discussions on professional subjects, yet the adjoining great and flourishing State of Illinois has not made any serious attempt in the same direction. Possibly this backwardness has arisen partly from the existence of the Western Society of Engineers with headquarters at Chicago, and partly from there not being found the parties who were willing to sacrifice time and labor and money, in the preliminary exertions absolutely necessary for the successful inauguration of such an enterprise. Prof. I. O. Baker, of Champaign, Ills., well known as a teacher of surveying and engineering, and the author of some of the most practical papers on land surveying that have ever been published, is now moving in this matter, and his appeal to the surveyors of Illinois is published on another page.

We heartily commend this movement of Prof. Baker, and hope it will be successful. As an independent association, mostly composed of land surveyors, with questions principally relating directly to the division of land, the settlement of boundary disputes, the construction of ordinary highways, and the drainage of low lands, there is no reason for any affiliation with an *engineering* society, but great reason why an opportunity should be afforded for a yearly convention, similar to those held in the adjoining states, to discuss the above important subjects, to exchange opinions, and to add strength and influence to their profession by organization. With an intelligent and energetic secretary to take charge of the details of the management; with a careful selection of a place of meeting; moderate fees and expenses, and a prospect of a creditable volume of proceedings each year, there is every reason for premising a very successful Surveyor's Association in the great and important State of Illinois.

A Correction.

In the list of tunnel contractors on the South Pennsylvania Railroad, given on page 306, issue of November 14th, there is a transposition of names in Tunnels Nos. 7, 8 and 9. These should read as follows:—

No. 7.	Negro Mountain.	John McGovern.
No. 8.	Quemahoning.	P. & T. Collins.
No. 9.	Laurel Hill.	Patterson & Kuhn.

As there was some trouble with the work on the Laurel Hill Tunnel and it was taken away from the contractors last April, we regret that such well known and energetic contractors as the Collins Bros. should have been accidentally credited with it.

Natural Gas For Glass-Making.

The application of natural gas to the manufacture of glass in the works of the Pittsburg (Pa.) Plate-Glass Co. promises to work a revolution in the process, and will enable them to compete successfully with the French and English plate-glass makers.

This company owns two wells, each about 1,150 feet deep and twenty miles from Pittsburg. One-half of the production of one well is all that the works now require; the surplus is used in heating and lighting the town of Creighton, near the wells; but as the supply is still in excess of all the demand a vent-tube from the wells is always burning.

The pressure at the wells is 240 pounds per square inch, this is reduced to 140 pounds at the wells and after passing to the glass-works in Pittsburg is eighty pounds, where it is still further reduced at pleasure before entering the furnaces.

It is claimed that glass made by this cheap fuel is decidedly superior to that made by the use of coal; no coloring matter can get into the melting pots, and there seem to be no harmful impurities in the gas, for no appreciable color can be seen when several inches of glass so made are looked through from edge to edge. The absolute control of the workmen over the degree of heat in the furnaces and annealing ovens enables glass of exceptional strength and durability to be made.

It is reported that glass-makers in Philadelphia, Boston, Covington, Ky., and other points are contemplating a removal of their works to the natural gas region. An English chemist, Mr. Colbert, has been visiting the gas regions in the interest of English capitalists and manufacturers, who had felt reluctant to believe all they heard of this new fuel. Mr. Colbert openly expresses his astonishment at what he saw, and thinks that half the benefits to be derived from this natural gas are yet unrealized. He said Englishmen would probably send their representatives here to secure plants and open manufacturies.

The only doubtful factor in this otherwise promising aspect of affairs about Pittsburg, is the woeful waste of this precious fuel going on on all sides. The hills about Pittsburg are lighted up by the enormous torches fed by the surplus of production over demand. Each burning jet represents so much heat and light utterly wasted, beyond any possibility of recovery. Whether human skill will ever invent any method of throttling this gigantic gas pressure that they have let loose in so many places, remains yet to be seen. So far, it seems that when the vein is once tapped the only feasible plan is to use what you can and waste the rest, for it is claimed that iron will not hold it and gauges can not measure the possible pressure at certain points.

Travel in New York.

AN editorial in a daily paper, apparently intended to boom a street car line on Fifth avenue, uses a line of argument that is interesting aside from its evident purpose. The editor has been delving into the figures of passenger traffic in New York to the following effect:

During the past thirty-two years, ending in 1884, the growth in passenger traffic upon all omnibus and railway lines, has increased at an average yearly rate of over 9,000,000. In 1853 it was less than 7,000,000 all told, and in 1884, the travel exceeded 302,000,000. While the population of the city has only doubled in

this time, the passenger traffic has become forty-three times as large; and taken by decades, passenger travel has shown an average increase of 141 per cent., and population 46 per cent.

This increase in population and travel has naturally been greater in the eight years that the elevated railroads have been in operation: the result of this extension of travelling facilities having been the rapid building up of the upper end of Manhattan Island and a consequent increase in population, and the demands for circulation. Reduced to figures, the whole number of passengers carried in 1877, when the elevated system was introduced, was not quite 164,000,000 on all city railway lines, exclusive of omnibuses. In 1884 this total was 284,000,000. Yet of this increase of 120,000,000 the elevated roads carried only about one-third. Contrary to the very general opinion of 1877, instead of destroying the business of the surface roads, they have actually stimulated travel on the latter, mainly because they have overcome their own capacity as the unbearable morning, and evening crush on the Sixth and Third avenue lines will testify.

Official figures show that between September 30, 1883, and September 30, 1884, the growth in passenger traffic was over 16,000,000. The last annual statement of the Manhattan Railway Company, of a few days ago, gives the grand total of travel over the elevated roads as 103,354,729, an increase of only about 6,000,000 over the previous year. The estimated total passenger traffic on all lines for the past year is over 310,000,000. And the total length of elevated roads has extended from 16 miles in 1878 to 32 miles in 1884, opening up to population the previously almost inaccessible district lying between Fifty-ninth street and Washington Heights.

American Bridges in English Colonies.

The last number of *The Engineer* contains the following: "An English engineer, well known in railway circles, says that American bridge builders are, for bridges of all ordinary sizes, completely cutting the English builders out of the market for Canada and other colonies, and that this is chiefly due to the baneful effects of the Board of Trade rules, which instead of improving have caused the depreciation of our bridges, by the use of the common materials which will stand four or five tons tensile or compressive strains."

It is possible that our contemporary has just learned that our bridge-building firms are cutting English builders out of colonial markets not only for bridges of all "ordinary sizes" but many of extraordinary size. They have only themselves to thank for their Board of Trade rules. The past greater cheapness of their raw material has enabled them to substitute weight of metal for the scientific adaptation of sizes and shapes in use with us; and for a long time their products found sale under the name of British solidity of construction. But now that pig-iron, Bessemer rails and refined iron in bars is only $4 to $5 per ton, and common iron only $5 to $6 cheaper in England than here and they are met with such statements as those lately made by Baker; that members of some English bridges would require strengthening to the amount of 60 to 160 per cent. before being up to American standards, there is no doubt about the cutting of their trade.

The editor of *The Engineer* should not have allowed the implication contained in the sentence "for bridges of all ordinary sizes" to have appeared; for as long ago as the building of the Intercolonial Railway, Clarke, Reeves & Co. got all the long and ordinary spans, the English builders securing only girders and structures not requiring trussing.

The Baltimore & Ohio's New York Terminal.

The contract between the Baltimore & Ohio Railroad Co., and the Staten Island Rapid Transit Co., whereby the former secures valuable terminal facilities for the New York end of its line, is exciting railroad and financial circles.

The opposition, represented by the Pennsylvania and the New Jersey Central railroad interests, and the cities of Paterson, Elizabeth and Newark, claim that the proposed project can not be carried out. They say that an iron-clad traffic agreement exists between the North Pennsylvania, the Delaware & Bound Brook and the New Jersey Central companies forbidding any diversion of travel; that the B. & O. can not get a charter to build the eighteen mile extension from Bound Brook to Elizabethport, because all the other Jersey roads will combine against them, and thirdly that the Transit Co. has no authority to bridge the Arthur Kill.

On the other hand, Mr. Erastus Wiman, of the Transit Co., says that the contract between the three roads mentioned has been modified so as to permit free interchange of traffic; that the B. & O. does not need a new charter to build the proposed extension, but has already organized a company and can construct under the general railroad law of New Jersey, and that as to crossing the Arthur Kill, only national legislation is needed, as the States of New York and New Jersey had already done all that was necessary in the matter; he had no fears but the requisite legislation from Congress will be secured at the coming session.

The proposed connection is outlined in the railroad column of this issue, so it is not necessary to repeat it here. The main point at issue would seem to be, aside from the antagonism of rival lines, the crossing of the Arthur Kill. U. S. Senator Sewall, of New Jersey, is authority for the statement that the property of the Staten Island Co. has been in the market for some time, with a view to making the island a depot for coal; but the difficulty of crossing the Arthur Kill has heretofore deterred investors. This channel is a link in the great inside water route from New York south through the Delaware and Raritan Canal, Delaware River, Schuylkill Canal, Chesapeake Canal, Chesapeake & Delaware Canal, and thence into Virginia and North Carolina. This traffic amounts in all to about 23,000,000 tons per year, and every attempt to obstruct it by a bridge that vessels could not pass under, would be resisted by the State of New Jersey. There is already a statute law prohibiting a bridge without special authority from the Legislature, and the Senators and Congressmen of New Jersey have been requested by the Legislature to oppose the granting by Congress of any right to build. The State of New Jersey has a direct and extensive interest in the value of the manufacturing sites along the Kill von Kull, which would decrease in this respect by reason of any obstruction to navigation.

Chinese Affairs.

We learn from the San Francisco *Chronicle* that the late Chinese general, Tso-tsung-Tang, who has long been at the head of the conservative or anti-foreign party, surprised his friends by making a report shortly before his death on the needs of China, in which he recommended a powerful fleet of iron-clads for coast defence, a torpedo flotilla, the establishment of a foundry for steel guns of the largest caliber, reform in the system of internal revenue and the building of railroads, with the foundation of a college for the education of Chinese youths in science, manufactures and mechanics.

On the death of General Tso, Li-Hung-Chung, who has long been in favor of the reforms thus recommended, was called to the Capitol to confer on the report. It is to be hoped that this conference will result in the development of the resources of China; and it would not be amiss if some of *our* influential statesmen would pay less attention to the proscription of Chinamen in this country, and more to the part the United States *might* take in assisting in the introduction of modern civilization among the Chinese at home. We believe it would be a more profitable undertaking and one more in accordance with our republican institutions and national needs.

PERSONAL.

GEORGE WALTERS, Chief Engineer of the Phoenix Iron Company, died at his home at Phoenixville, Penn., on the 20th, after a short illness.

PETER PRIME, a prominent contractor of Little Falls, N. Y., fell from a roof on the 21st, and was killed.

G. E. DATESMAN, of the Philadelphia City Surveyor's office, was married November 19th, to MISS MINNIE OSTERSTOCK.

CITY ENGINEER JOHN H. ROUSER, of Piqua, Ohio, died November 19th at Cincinnati, Ohio.

MR. FRANK G. DARLINGTON has been appointed Superintendent of the Cincinnati and Muskingum Valley Division, vice W. F. Black, transferred. To take effect December 1st, 1885.

Mr. F. L. HINCKLEY is appointed Superintendent of the Wabash, Chester and Western Railroad, with office in Chester, Ills., in place of ROBERT MEEK, resigned.

R. M. POMEROY, formerly President of the Union Pacific Railroad, died at his residence in Boston, November 18th, aged 70.

The following passed their final examination at Ottawa, Canada, November 19th as Dominion Land Surveyors: F. H. LATIMER, Winnipeg; J. G. WOODS, Aylmer. There were very few candidates at this examination.

Mr. F. P. ABERCROMBIE has been appointed Assistant Engineer of the Sunbury and Shamokin divisions of the Northern Central Railroad of New Jersey, in place of Mr. G. W. CREIGHTON. Mr. CREIGHTON is transferred to the West Jersey road, taking the place vacated by Mr. ABERCROMBIE.

COL. HENRY STURGIS RUSSELL, of Boston, Mass., has been selected as Vice President of the London-American Exhibition of 1886. Col. Russell was born in Boston in 1838; graduated at Harvard in 1860; served gallantly in the late war, leaving it as Colonel of the 5th Mass. Cavalry, and is now the President of the (Bell) Continental Telephone Co. of Boston.

Mr. H. A. YOUNG has been appointed Superintendent of the Toledo Division of the Toledo, Cincinnati & St. Louis Railroad, in addition to his duties as Chief Engineer. Mr. B. S. MCLEOD has been appointed Superintendent of the St. Louis Division of that road and will have charge of maintenance of way under the direction of the Chief Engineer. The office of Master of Trains has been abolished.

JAMES GILMER SPEED, of Louisville, Ky. and New York City, has been appointed Secretary of the London-American Exhibition of 1886. Mr. Speed is a nephew of James Speed, Attorney Gen'l. of the U. S. in Mr. Lincoln's administration; he commenced his professional life as a civil engineer, first as Assistant City Engineer of Louisville, Ky. and then Engineer of the Louisville, Cincinnati & Lexington R. R. In 1876 Mr. Speed was con-

nected with the Transportation Bureau of the Centennial Exhibition and later he joined the editorial staff of the *New York World* and afterwards became Managing Editor and Publisher of *The World*. Mr. Speed is only 33 years of age and has been associated with the London-American Exhibition for a year as Commissioner-General.

THE Panama Canal Company wants a civil engineer to go to Panama. Salary $8,000 and free quarters. None but *French-Speaking* engineers need apply. The office of the company in New York is in the Mills Building, Wall and Broad streets. Mr. Chas. Colné is the Secretary in charge of American business.

Chief Engineer BRIGGS, of the Mexican Central Railroad, has resigned and will shortly return to the United States. The engineering department has been abolished and its business has been transferred to the superintendent's department. Mr. VAUGHN has been appointed Track Master of the First and Second divisions of the road, and Mr. VINCENT JACKSON, Track Master of the Third and Fourth divisions. The retirement of Chief Engineer BRIGGS removes from the service of the company the last of the original staff engaged in the early constuction of the road.

The President has appointed RICHARD P. HAMMOND, Jr., to be Surveyor-General of California, vice William H. Browne, resigned, to take effect Jan. 1. Mr. Hammond is a son of Mayor R. P. Hammond of San Francisco, the last Democratic Collector of that port, and a nephew of the famous Col. Jack Hayes, the Texas ranger, and first Sheriff of the city of San Francisco, who was also the last Democratic United States Surveyor-General of California. He is a native of the State, 28 years of age, a civil engineer by profession and a graduate of the State University of California.

M. DE LESSEPS celebrated his 80th birthday at Paris, November 19th. He and his family went to a thanksgiving mass at their parish church. The sturdy old canal maker received benedictions by telegraph from the Pope and the Bishops of Colombia. A large number of Suez shareholders, in gratitude for their great fortunes due to the octogenarian of to-day, filled his library with bouquets and rich presents. The Turkish, Spanish, Brazilian and Portugese embassies and legations waited on him in the names of their sovereigns, and the Ex-Khedive, as well as the actual Khedive, telegraphed their congratulations. M. de Lesseps looked quite lively, and had something to say to each one of the innumerable visitors which differed from what he had said to any one else. The Empress Eugenie sent a dispatch, which had the place of honor. To all questions about the Panama Canal, M. de Lesseps said, enthusiastically: "I shall yet live to sail through it."

DAUPHIN S. HINES of the firm of Henry R. Worthington died at his home, 72 Second Place, Brooklyn, on the 10th, at the age of 56 years. Mr. HINES was born at Stil.water, R. I.; at the age of 20 he entered as a working machinist the shops of Messrs. Worthington & Baker; in 1854, MR. HINES took charge of the office, drafting room, and buying department of the Henry R. Worthington "Hydraulic Works" in Brooklyn, becoming, within two or three years, general manager and superintendent, which position he occupied up to the time his health began to fail in 1880.

In 1865 he entered into partnership with Mr. Worthington and W. A. Perry, the firm retaining the same title, Henry R. Worthington.

That partnership being dissolved in 1880 by the death of Mr. Worthington, a new partnership was formed, under the same title, by Mr. Hines, Mr. Perry and Charles C. Worthington, a son of Henry R. Worthington, though for the past three or four years failing health has prevented Mr. Hines from taking any active part in the business.

EX-Mayor BOWMAN of East St. Louis, Ills., assassinated last week, was born of Hebrew parents in Mannheim, Germany, in 1832; was educated at the University of Heidelberg, and when only seventeen years old joined the revolutionary forces under Frederick Hecker. After the collapse of the revolution he fled to London; afterwards travelled over Europe, keeping out of Germany, and then came to America and stopped with Col. Hecker, who had in the meantime located on a farm in St. Clair County, Ill. Two years later he became the private secretary of Senator Thomas H. Benton, of Missouri, and was Benton's second in one of his duels. Benton obtained a post-office for him at Knob Noster, Johnson County, Mo. His commission as postmaster was made out in the name of John B. Bowman, and that was how he came to be called Bowman.

He next figured as a school teacher in Cantine, St. Clair County, Ill. In 1859 he removed to East St. Louis and was elected a Justice of the Peace. Then he became by turns a real estate and insurance agent, civil engineer and lawyer. He obtained a charter for the city in 1865 and was the father of the city's gas works, street railway system, dikes and other public improvements.

Illinois Engineers and Surveyors.

UNIVERSITY OF ILLINOIS.
SCHOOL OF CIVIL ENGINEERING.
CHAMPAIGN, ILL., NOV. 17, 1885.

A circular has been sent to all civil engineers and surveyors whose addresses could be learned, asking an expression of opinion as to the advisability of organizing a state association of engineers and surveyors similar to those of Indiana, Ohio, Michigan, and Missouri. All interested in such association are requested to send their views to the undersigned; and if the number and nature of the replies warrant it, he will issue a second circular announcing the result, and request advice as to further arrangements.

I. O. BAKER,
Champaign, Ills.

St. Louis Engineers' Club Circular.

To the Editor of ENGINEERING NEWS.

ST. LOUIS, MO., NOV. 19, 1885.

The undersigned committee of the Engineers' Club of St. Louis would respectfully call your attention to the following action:

Whereas, The Engineers' Club of St. Louis did on March 18, 1885, appoint a committee to "Consider and report on the best means of improving the status of civil engineers in the service of the general government," and

Whereas, Said committee after due deliberation decided that this subject was not of sufficient general interest or importance to justify the Club in initiating or supporting a movement tending to simply legislate in the interest of a certain class, and

Whereas, The committee, in accordance with these views, reported to the Club on May 13, 1885, that it "regrets to see the discussion of the subject turning aside from the broad question of creating an organization for the conduct of public works." And furthermore, that "to this question personal matters, past, present or future, the value of the different schools and modes of training, or the honesty and truthfulness indicated through certain associations, are alike foreign. There seems, therefore, to be need for conservative influence lest the utterances of individuals be taken as expressing the views and wishes of the engineering profession and lest a discussion of a pure question of public policy degenerate into a controversy about matters of no consequence." And

Whereas The committee was continued to consider this broader question and make an effort, through "correspondence and conference" with other societies, to reach some common ground of action ultimately terminating in a convention to formulate a plan for creating an organization to conduct our public works, and all questions relating thereto being still under consideration. Therefore be it

Resolved, That this committee does not deem it expedient to send a representative to the convention called to meet in Cleveland for the purpose of promoting class legislation, a matter foreign to the declared purposes for which this committee was continued.

Resolved, That copies of these resolutions be furnished the several engineering societies of the country.

ROBERT E. MCMATH,
J. A. OCKERSON,
J. B. JOHNSON,
H. S. PRITCHETT,
Committee.

The Cleveland Convention.

CLEVELAND, O., NOV. 23d, 1885.

Dear Sir:—We are just in receipt of a circular from the Committee of the Engineers' Club of St. Louis, also addressed to other Clubs, giving notice that the said Committee, for reasons given, deems it inexpedient to send a delegate to Cleveland "for the purpose of promoting class legislation.

As this is manifestly unjust to all who have interested themselves in the subject, whether in Cleveland or in other cities, and as it comes to us under date of November 6th, of the appointment of a delegate who would attend if the character of other delegates were satistory to them, we deem it advisable to send this additional circular to correct the list of delegates by omitting that of St. Louis.

The communications from this Committee, as well as all those received by it, with the single exception of the earlier ones from St. Louis, have invariably outlined *not* a class legislation, but a conservative, professional and non-political course for the welfare of the country as well as that of Civilian Engineers.

This much we consider necessary for the protection of all who have interested themselves in the meeting.

By Order of the Committee,
WM. T. BLUNT, *Secretary.*

Michigan Engineering Society.

The next annual meeting of this Society will be held in Ann Arbor, Michigan, not in Lansing, as wrongly stated in our notice last week.

LITERATURE.

Transactions of the American Society of Civil Engineers. October, 1885.

CONTENTS:—New Method of Making Conventional Signs on Original Topographical Maps, by J. A. OCKERSON. Power Brakes for Freight Trains, by WILLIAM P. SHINN.

Journal of the Association of Engineering Societies. September, 1885.

CONTENTS: Water Power at Niagara Falls, by SAMUEL MCELROY. The Wellesley (Mass.) Water Works, by FRANK L. FULLER. Reminiscences of the Construction of the New York, West Shore & Buffalo Railroad, by WILLIAM H. SEARLES. The Quantity of Air required in the Ventilation of Buildings, by R. F. HARTFORD. An American Engineering Literature Society, by J. A. L. WADDELL.

The Magazine of Art. December, 1885.

The last number of this publication of Cassell & Company well earns the praise the London *Graphic* gives it of being "the best written and best illustrated of the Art periodicals." This number has as a frontispiece a superb reproduction of one of Jacob Van Ruysdael's originals in the Brunswick Gallery. The first article is a sketch of J. W. Waterhouse, A. R. A., with specimens of his work. "Art in Egypt" is an exceedingly interesting article and "American Silverwork" is a revelation to those who are only familiar with our art-

workmanship of a decade ago; in this last the writer, who seems to be an Englishman, gives all praise to our American skill, finish and variety and beauty of design; he says they are incomparably better than the English article intended for the same purpose and are much cheaper. "The Romance of Art," "The Lower Medway," "French Theatrical Museum," "The Beginning of the Royal Academy" and "A Chapter on Chairs," with many handsome illustrations, complete this excellent number of an always excellent magazine.

Annual Report of the Chief of Engineers. United States Army, for the fiscal year ending June 30, 1885. Washington, D. C.

Gen. John Newton, Chief of Engineers, U. S. A., has forwarded his annual report, as above, under date of October 16, 1885. We make the following extracts:

The total number of commissioned officers in the Corps of Engineers, on June 30, 1885, was 107 on the active list and eight on the retired list. Of this number, twenty-six are on fortification and river and harbor works; thirty are on river and harbor works and eighteen are with the Battalion of Engineers. The remaining officers are on various details, and twenty-three are on detached service, on duty with the Lieutenant General of the Army, generals of divisions and departments, Lighthouse Board, Military Academy, Mississippi and Missouri River Commissions, etc.

During the year all operations on sea coast and lake-frontier defenses have been restricted to such as are required for the preservation and repair of existing works. General Newton again calls the attention of Congress to the urgent need of a defensive system for the country. The estimate of appropriations required for the modification and repair of existing works, for torpedoes, etc., for 1886-87, is $1,274,000. One $10,000 item in this list contains a biting commentary on our "sea defences:" this is for Fort Marion, Florida, for which General Newton asks the above amount to restore the old fort "to the condition substantially in which it was left by the Spaniards."

The "Defenses" of New York and the Brooklyn Navy Yard are evidently a misnomer. The only protective works at the entrance from Long Island Sound are found in Fort Schuyler, an old masonry fort of the design of half a century ago and three unfinished earthen batteries; of modern armament there is none. The fort at Willet's Point is also an old unfinished stone fort, with four incomplete earthen batteries armed by sixteen mortars.

The forts at the entrance to New York Harbor from the South are in somewhat better shape, but are still far removed in armament and protective works from the requirements of modern warfare. Fort Lafayette, occupying "the best of all positions for the defense of New York Harbor," is practically a worthless ruin as left after the fire of 1868. It is proposed to replace it by a modern iron construction, and plans have been prepared, but there are no appropriations for carrying them out. The term that a certain battery could concentrate a heavy fire on enemy's ships" if the battery was properly armed," occurs with uncomfortable frequency in describing the forts about the entrance to our chief commercial city.

Without going into detail, the same state of affairs as mentioned above, exists along our whole Atlantic, Gulf, Pacific and lake coast.

The Board of Engineers, stationed at New York and consisting of Col. J. C. Duane, Lieut. Col. H. L. Abbot, and Lieut. Col. C. B. Comstock have in the past fiscal year presented estimates for the construction of defensive works for the principal harbors of the United States; plans and estimates for revolving iron turrets on an artificial island or bare rock; details of a proposed 5-inch siege breech-loading rifle, and for a number of other items of defense.

The Board, in discussing torpedo defense, states that the wording of the Act of Congress providing for the year 1884-85, restricted it to the purchase and improvement of the Sims' movable torpedo; but they further state that this torpedo is still in an experimental stage and advise that further trials be made before any number of them be placed in store. The Board advises that a large number of fixed mines, the details of which have been thoroughly studied, be provided. These mines are intended for obstructing channels and at present "they constitute our chief dependence for excluding hostile fleets from our ports." An appropriation of $300,000 is strongly recommended for their purchase during the coming year, together with $200,000 for constructing operating casements, shafts and galleries for the introduction of the electric cables into fortifications.

General Abbot, in reporting upon the progress made at Willets' Point, speaks as follows of the testing of new explosives: "As to the practical value of the new explosive, rackarock, consisting of potassium chlorate and a fluid hydro-carbon, it joins absolute safety in transportation and storage to a strength nearly, or quite, equal to that of dynamite No. 1. Explosive gelatine, approximately represented in our market by Forcite gelatine, is the strongest of known explosives. Judson powder, costing about the same as potassium nitrate blasting powder, has an intensity of action equal to about 40 per cent. of dynamite No. 1, although it contains only 5 per cent. of nitro-glycerine. All these remarks apply to explosives under a considerable depth of water and well removed from the bottom."

As even an abstract of the work of the Engineer Corps, under the head of "River and Harbor Improvement" would fill a paper by itself, we pass by this portion of the report of General Newton. We would, however, remark that in connection with the removing of obstructions in the East River and Hell Gate, New York, the amount asked for the fiscal year ending June 30, 1887, is $500,000; to be expended as follows: for grappling and removing the broken rock after explosion of Flood Rock, $250,000: for completing the removal of Pot Rock, Frying Pan, Heel Tap at Hell Gate, and for beginning the removal of a reef near Diamond Reef, in the East River, $180,000; and for commencing work on Negro Point, $70,000. The estimated amount required for the entire and permanent completion of this work of improvement in accordance with adopted plans is $1,601,340.67.

Report of the U. S. Geological Survey.

WASHINGTON, Nov. 12.—It appears from the reports of the director of the geological survey to the Secretary of the Interior that accurate topographical surveys have been extended over considerable portions of most of the States south of the 39th parallel and east of the Rio Grande. The areas actually surveyed in these States up to date, as shown by these reports, are as follows:

States.	Square miles.
Maryland	1,500
Virginia	11,000
West Virginia	10,000
Kentucky	4,000
North Carolina	6,500
Tennessee	11,000
Georgia	4,400
Alabama	6,000
Missouri	13,000
Kansas	19,000
Texas	12,000
Total	98,400

The maps constructed from these surveys represent the natural features, the political divisions, etc., of the country in great detail. Not only the larger lakes and rivers, but even the smaller streams and springs are shown; and not only the broader plains and higher mountains, but also the smaller hills and valleys diversifying the surface of the country and affecting its value in many ways, appear upon them. They exhibit too, the smaller as well as the greater political divisions, the public roads, railways and canals, and all towns and villages. It is evident that the surveys are made with great care; for it is the avowed purpose of the United States geological survey to make the topographic survey once for all, and to construct maps that shall endure the severe test of practical use for all purposes to which accurate maps can be applied. Thus far none of these maps appear to have been published; but the reports show that a large number (including 52,000 square miles in the area, are in the hands of draughtsmen, engravers and printers, and that their issue will commence within a few months.

It is difficult for those who have not used them to estimate the value of accurate topographic maps; but wherever such maps have been constructed, it has been found that a great demand for them has rapidly grown up, and that they are applied to a great variety of uses. Thus, in the European countries in which maps similar to those of the United States geological survey have been prepared, and in all cases such maps have been constructed and issued under government auspices, it has been found that they are employed in laying out railways and canals, thereby saving the cost of preliminary surveys; that mill sites, factories and villages are located from them; that in hilly and mountainous regions, roads may be laid out by them without the cost of special surveys or expensive grading, in case such surveys are not made; and that questions of the drainage of swamps and lands subject to inundation, of sewerage in cities, and of water supply to towns, villages and dwellings, may be readily decided by their use. In this country a few such maps have been prepared, and wherever they have appeared they have been applied to all imaginable uses, as in Colorado, where the ranchero locates his irrigation canals by the maps issued by the Hayden survey of the Territories, and in New Jersey, where the wheelsman locates his route, and the farmer his cellar drain, by the maps prepared by the geological survey. But the need of such maps in the South is greater than in densely populated Europe, greater than in mountainous and arid Colorado, greater than in long settled New Jersey, for our magnificent resources are not yet appreciated, and such maps will facilitate their development. Coal and iron are locked up in our hills; inexhaustible quantities of phosphates and other natural fertilizers are buried beneath our plains, and as these resources are developed our fields of cotton, cane and corn must be multiplied and extended, our extensive forests must be utilized, railways must be constructed, mills and factories must be built. We require accurate maps in the first place to invite capital, and in the second place to direct the investment of capital; and the uses for accurate maps are thus immediate as well as prospective. Great sums are annually expended in the construction and publication of maps for commercial, educational and other uses by private parties, corporations and institutions. Since they are not based on accurate surveys, these maps are necessarily imperfect; and since they are issued in small editions, publication is expensive, and imposes a heavy tax upon the consumers who purchase them. Expenditures for such purposes will be greatly reduced when the maps of the United States geological survey are published in large editions and made accessible to the people for whose use they are prepared.

But from the published reports of the director it appears that however valuable they may be *per se*, the topographic maps do not constitute the end sought by the survey, but are only a necessary means to an end. They are designed in the first place to facilitate geological investigation, both scientific and economic, but chiefly to convey the results of such investigation to the people. Ultimately every coal seam, every mineral vein, every ore deposit, every important limestone ledge, every phosphate and marl bed that can be found after careful research, will be laid down upon the maps of the survey. The investigation of these resources is, indeed, the principal function of the institution, and, as appears from its last published report, the topographic survey was undertaken in various sections only because there are not in existence topographic maps suitable for the use of the geologist.

Since the geologic work is naturally and necessarily held in abeyance pending the completion of the topographic surveys, and the publication of the maps, but a limited amount of geologic work has been accomplished in the South since the work of the survey was extended into the States; but enough has been done to show the disposition of the survey.

Reports submitted to the Secretary of the Interior show that no fewer than eight geological parties have been employed in the Southern States during the current fiscal year.

One party has been engaged in investigating the coal deposits in northern West Virginia and southwestern Pennsylvania. A second party has been at work in the Blue Ridge mountains and contiguous parts of the "Great Valley" in the Virginias and Maryland. A party, including three of the abler officers of the survey, has been engaged in investigating the deposits upon which are situated the cities of Baltimore, Washington, Fredericksburg, Richmond, and Petersburg. Already some valuable results have come from the work of this party, e. g., the health officer of the District of Columbia reports that the work of the Geological Survey in that District has enabled him to decide important questions relating to the location of wells, and the use of water from springs, and other questions affecting public health in the environs of Washington during the past year, and the data now in the hands of the survey are sufficiently full and definite to obviate the necessity for expensive surveys in locating tunnels, reservoirs, etc., such as have been necessarily incurred from time to time during the past decade. A fourth party has been engaged in investigating the Richmond, Deep river and Dan river coal fields in Virginia and North Carolina. A valuable contribution to technical knowledge of these coal fields has already been published by the survey as a monograph, entitled "The Older Mesozoic Flora of Virginia." It was prepared by Prof. Wm. M. Fontaine, of the University of Virginia. Data for the economical reports on these fields are being collected. Two parties have been studying the rocks and resources of Eastern Tennessee and adjacent parts of North Carolina. Another party has been engaged in making reconnoissances and collections preliminary to the survey proper in Alabama, Mississippi and Louisiana, and during the summer of 1884, the same party was employed in geologic reconnoissance of the Alabama and Tombigbee rivers.

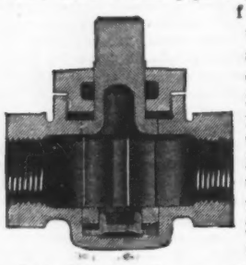
The results of this work are the discovery of valuable phosphatic deposits in several localities, the examination of various marl beds, iron ore deposits, etc. Another party has been employed in constructing a geologic section through Southeastern Colorado and Southern Kansas for the purpose of correlating the rocks of the Rocky Mountain region with those of the Mississippi valley, and of determining the extent of coal-bearing, lead-bearing zinc-bearing, and other important formations of Kansas and Northern Texas.

Finally, it appears from the director's report that there is in the hands of the survey a memoir on the geology of Texas, Indian Territory, Arkansas and Louisiana, in which it is proposed to bring together the results of all geologic investigation in those States in the form of a compendium designed for the immediate use of the people of these States, as well as for field use by the geologists engaged in the detailed surveys shortly to be instituted in the region.

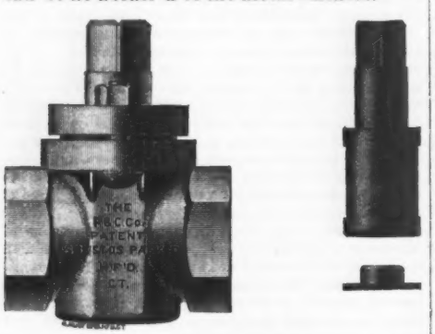
Obviously, the time has not yet come for estimating the value of the purely geological work of the survey in the Southern States; but it is probable that intelligent citizens of these States will be satisfied with the knowledge that such work has been planned on a grand and a comprehensive scale, and that these plans are being put in execution as rapidly as is possible under the present appropriations.

Asbestos-Packed Cocks, for Water, Steam and Gas.

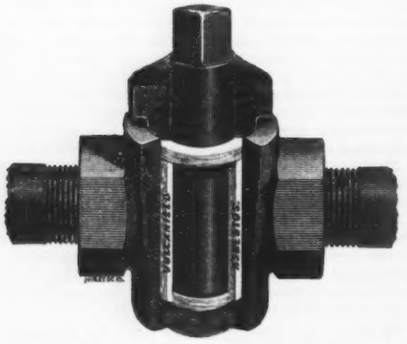
While it is generally admitted that a plug-cock, with a full pipe capacity, is the best form of shut-off with steam, water and gas, its very construction defeats its usefulness when exposed to binding from heat expansion or to the cutting of the metal surfaces in contact by sediment or grit.



This difficulty in one of the most common appliances used in mechanical engineering seems to have been entirely removed in the device perfected by John Lawrence & Co., of London, England. This straight-way cock is very like the form in ordinary use excepting that the shell is provided inside with four or more longitudinal dove-tailed grooves for the reception of a packing of vulcanized asbestos; and an upper and a lower packing-ring of the same material complete the device. By this arrangement the plug never touches the metal part of the shell at all; and having sufficient space to allow for expansion, binding from this cause is impossible; and an experience of about five years shows that there is practically no wear in the elastic asbestos packing. As the plug and shell are not in contact, there can be no abrasion of the metal surfaces.



These asbestos-packed cocks are now being put on the American market by Messrs. Fairbanks & Co., of 311 Broadway, New York, and at their request a very severe test of their efficiency and durability has been made at the United States Navy Yard, in Brooklyn. In this test the new cock was fitted with a standpipe at each end filled with boiler sediment and water. The plug was then attached to a part of the shop machinery making 275 strokes per minute. In this manner the plug was worked for eleven hours, opening and closing the cock in that time 17,870 times. As an average of 20 times a day is a fair working for a cock



in ordinary use, this test was equivalent to about 2½ years duty in gritty water. On the completion of the trial the cock showed no leakage; and was found to be perfectly tight under a steam pressure of 45 pounds above the atmospheric pressure. No signs of wear or abrasion were visible when the cock was afterwards taken apart. This report, made to the Chief of the Bureau of Steam Engineering of the United States Navy, was signed by Com. R. Chandler, commanding yard, and N. P. Towne, James H. Chasmar and James H. Perry, Principal Assistant Engineers, United States Navy.

A number of prominent manufacturing firms, who have tried the asbestos-packed cocks, are loud in their praise of their efficiency under very trying circumstances.

Railroads in the South.—The Record for Five Years.

The Baltimore *Manufacturers' Record* gives an interesting account of the increase since 1880, in the railroad interests of the South.

Many of the old roads in existence in 1880 have been purchased since by syndicates, and vastly improved and extended, so as to develop new territory or make new connections. Besides this, however, several hundred million dollars have been expended in building new roads, and a wonderful impetus has been given to the development of the latent resources of the Southern States.

The increase in mileage alone in five years has been 9,323 miles. The smallest increase in any one State was forty-two miles in Maryland, where there has been but little railroad building for some years. South Carolina comes next with 136 miles. Virginia shows an increase of 794 miles, which is exceeded by only two States, Texas and Arkansas.

The building of the new roads in Virginia has caused a very marked improvement in many parts of that State, and has led to the establishment of important industries.

In North Carolina 452 miles of new road have been built, some of the lines being of especial importance because they penetrate the magnificent territory in the West.

Georgia has added 518 miles to its railroad system; while Florida, with a population of less than 400,000, has built 776 miles, and now has 1,324, against 548 in 1880.

The remarkable development of Florida during the last five years and the enormous winter travel account, of course, for the activity there.

Alabama shows an increase of 347 miles, largely due to the building of roads to open up its vast mineral resources.

In Mississippi the gain has been 716 miles, in Louisiana 663 miles, and in Tennessee 322 miles. Texas has increased its mileage from 3244 miles in 1880 to 6198 miles in 1884, a gain of 2954 miles. Present indications point to great activity in railroad building in Texas during the next year or two, but considering the immense size and enormous resources of the State the increase is not likely to prove excessive.

Arkansas has more than doubled its lines in five years, and now has 1764 miles of road against 859 miles in 1880. In Kentucky and West Virginia the increase has been nearly the same, 356 miles in the former and 335 miles in the latter.

On the basis of $30,000 as the average cost per mile, nearly $300,000,000 were spent from December 31, 1880, to December 31, 1884, in building new railroads in the South. This, however, does not represent the whole expenditure in the development of Southern railroad interests, as a vast additional amount of northern and foreign capital, as well as local capital, has been expended in the purchase and improvement of old railroads. A good idea of the magnitude of the total expenditure can be obtained from the following comparative statement of the capital investment, including stocks and bonds, of Southern railroads in 1880 and 1884, as shown in Poor's Railroad Manual:

States.	1884.	1880.
Maryland	$ 92,992,617	$ 84,859,298
Virginia	197,864,010	119,831,946
N. Carolina	41,413,342	32,730,559
S. Carolina	44,614,326	32,855,618
Georgia	88,219,190	55,517,342
Florida	36,598,300	7,423,000
Alabama	73,013,319	69,222,157
Mississippi	30,593,101	10,062,340
Louisiana	79,314,600	43,820,139
Tennessee	156,259,325	44,823,743
Texas	255,018,346	104,376,797
Arkansas	41,940,456	19,736,593
Kentucky	170,559,413	88,225,486
West Virginia	27,236,883	6,188,321
Total	$1,326,637,228	$719,673,249

Increase from December 31, 1880, to December 31, 1884, $606,963,979.

The actual cost of these roads and their equipments is given as $1,237,408,051, against $679,804,828 in 1880, and the actual cost, therefore, of the improvements of old roads and the building of new roads in the South in the four years reaches the enormous total of $557,603,223.

In 1880 the South had only 4,226 miles of steel track, against 14,494 in 1885; the proportion of steel track to the whole mileage has been increased from about 20 per cent. to over 50 per cent. in five years. South Carolina had in 1880 175.85 miles of steel rails in a total mileage of 1,427, against 757.43, and 1,563.55 miles respectively in 1885, an increase of over 400 per cent. There are still about 14,000 miles of iron track in the South which must, in the natural course of improvement, be shortly replaced with steel. The Southern railroads now have in operation 4,000 engines, 2,358 baggage cars, 953 special cars and 93,961 freight cars.

The whole South, it should be remembered, has grown with the growth of its railroads. These could not have multiplied and prospered in a sterile country or among an idle people. The roads have been built for a purpose, and that purpose was to meet the urgent demands of the country through which they run for new or better facilities of communication. The millions of dollars which have been invested represent the faith and confidence of the shrewdest men in the Union in the present and future of the Southern States, and their faith is justified with every passing year. Great as has been the progress already made, moreover, it is only a beginning. Another decade will see the South as far in advance of its present position as it is now in advance of the place which it occupied ten years ago. The extension of its railroad systems indicates the growth that is going on everywhere, but does not measure it. Development is taking place along a thousand lines, of which the railroads form only one.

Apparatus for Washing Rails.*

(Giornale del Genie Civile, 1885, p. 195.)

The Swiss Central Railway Company make use of hot water, issuing at a high pressure, for washing the rails in the Hauenstein tunnel, which is about 1½ mile long, and is a straight line on a gradient of 28.2 per 1000. In the first instance a low pressure was tried, but the adhesion diminished instead of increasing, and high pressure was then adopted. A small ejector is placed upon the footplate; this is actuated by steam from the boiler, which forces the water (drawn from the tender-tank) along a 1-inch pipe to the front of the engine. The pipe is then divided into two branches, which discharge the water, by orifices ¼ inch in diameter, at a temperature of 140° Fahrenheit, and a velocity of 92 feet per second, at points about 2½ inches above the rails, a little in advance of the wheels. The consumption of water is about 11 gallons per minute. The effect is that the rails are thoroughly cleansed, and slipping of wheels, which was constantly occurring in this tunnel before the system was adopted, now very rarely takes place. Sand is seldom required, and the wear of the rails and tires is greatly diminished. The company has fitted the apparatus to all the six-wheel coupled tender engines, which work both the passenger and goods trains through the tunnel. The engines are still fitted with sand-boxes, sand being used in the open.

*From "Abstracts," Institution of Civil Engineers.

WATER

PITTSFIELD, MASS., has placed a water loan of $50,000 in 30-year 4 per cent. bonds at 106.

A WINDMILL furnishes the motive power of Odebolt's, Iowa, water-works.

THE Chatham, Ills., coal shaft reached a six or seven foot vein of coal November 20.

(*Special.*) Jos. Miller, Mayor of Racine, Wis., telegraphs us: "Racine is perfecting arrangements to put in water-works. Correspondence solicited."

THE Pittsburg, Pa., Producer Oil Company struck a strong vein of natural gas at their Marr station well a few days ago.

THE Gardiner, Me., Water-works were tested on the 20th. The Gardiner Water Company was organized last winter with a capital of $200,000. M. M. Tidd, Engineer.

THE People's and Consumers' Gas Company, of Brooklyn, have filed a certificate of incorporation. Capital $3,000,000.

NATURAL gas has been struck on the farm of Joseph Brigham, three miles north of Princeton, Ill. Its heating qualities are good and the illuminating qualities are pronounced fair.

MR. DRIVER of Racine, Wis., has been in Oshkosh looking over the water-works ordinances. He is interested in having similar work put in at Racine and is endeavoring to create some interest in the project.

THE Harrison, Pa., Gas Company, capital stock 2,500, which proposes to furnish gas to the citizens of Harrison and Fawn townships, and Borough of Tarentum, Allegheny county, was chartered last week.

THE artesian well at Yamacraw, Ga., has reached water at a depth of 305 feet. The water is pure and soft with a trace of sulphur. The well is one and one-half inches diameter at the bottom.

HARRISBURG, PA., Nov. 23.—The People's Natural Gas and Pipage Company, of Pittsburg, capital stock $100,000, was chartered to-day. The directors are D. B. Oliver and J. H. Wright, of Allegheny, and James Irwin, of Bellevue borough.

VICE-CHANCELLOR Bird on the 20th instant, dismissed the application for an injunction to restrain Asbury Park from using the artesian well which was bored in close proximity to the Ocean Grove well, and from which Ocean Grove receives its water supply.

A YACHT built for experimental purposes was launched at Brooklyn this week. Her propelling power is electricity, and the machinery has been made by John A. Secor, whose grandfather is said to have made that for the Robert Fulton, which revolutionized water carriage in her day.

BUFFALO, Nov. 17.—The immense new sewer constructed at a cost of over a million dollars, for the purpose of draining the Hamburg canal, was put in full operation to-day. The sewer empties into Niagara river.

A TELEGRAM to the Chicago *Tribune* says that it is understood that Jesse W. Starr will abandon his contract for constructing a system of water-works for Wabash, Ind., and that a demand is being made upon the Council to advertise for new proposals for putting in the works.

GALLATIN, TENN., Nov. 19th.—At a meeting of the Mayor and Board of Aldermen to-night, the corporation granted free right of way to the Chesapeake & Nashville Railroad through the corporation, and also appointed a committee, composed of Dr. R. Tompkins, J. W. Harrison, Col. Turner and Wm. H. Spradlin, to look into the matter of water-works at Gallatin. Water will be pumped from the Cumberland river, three miles from Gallatin.

ROCKLAND and Abington, Mass., had a town meeting on the 23rd in regard to water-works. The meeting organized with a choice of George H. Hunt, as moderator. The report of the committee was tendered by George H. Hunt, and accepted by the meeting. It was to issue bonds to the amount of $100,000, said bonds to bear interest at the rate of 4 per cent. per annum. It was also voted to direct the water commissioners to contract for and lay water pipe and other appliances within the limits of Rockland. The construction committee of Rockland was authorized, acting jointly with the construction committee of Abington, to make such contracts in relation to such joint works as they may legally do under the act. It was moved that the water commissioners and construction committee make such division of expense as they may deem equitable. The supply is to come from Big Sandy pond, where a pumping station will be built, a stand pipe will also be necessary, and there will be seven miles of main pipe from the pond to the point of distribution. The attitude of South Abington, which has not yet accepted the act of the Legislature, is regarded with considerable interest by the citizens of the other two towns, for, should that town refuse to accept the act, it would delay the work.—Boston *Globe*.

THE new artesian well at Eastman, Ga., is nearly 300 feet deep.

EVIDENCE given before the Royal Commission on trade depression shows that the iron trade in the North of England, from 1881 to 1885, decreased almost one-half as compared with that from 1871 to 1883. The falling off is attributed to colonial protection, and manufacturers urge federation in order to prevent the shutting out of British goods from the colonies.

TAYLORSVILLE, ILLS., is not likely to have water-works, after all. The citizens voted with the understanding that the works were not to cost more than $20,000. Bids have been received, and the lowest bid reached $25,000. Rockford, Ills., is in a similar condition, in this case bids being high because of fear of rock in the trenches.

THE City Council of Kankakee, Ill., are considering the proposition of local capitalists to erect water-works on "reasonable terms." The proposition is to construct works of 2,000,000 gallons daily capacity, using nine miles of distribution. Kankakee has already advertised several times, but each time the bids were so high that all were rejected; the bids were high because of the possibility that many of the trenches might have to be opened in the solid rock, which crops out in many places in the city.

SEALED proposals will be received at the office of the Commissioner of Public Lands and Buildings, until December 22, 1885, for the sinking of a well on the big salt basin, near the City of Lincoln, Nebraska. Said well shall be tubed with iron tubing, of sufficient thickness to effectually exclude all veins and flows of fresh water passed through in sinking the same. Proposals are required to be submitted as follows, to wit: Price per foot for each 100 feet to the depth of 2,000 feet.

SOUTH TOLEDO, OHIO, November 18.—At about four o'clock this morning a splendid supply of natural gas was struck at the well being sunk here, and every body is happy. It is said that the well is fully as good as the best at Bowling Green.

The Toledo Glass Sand Company will at once build glass works.

PUMPING ENGINES.—The Southwark Foundry and Machine Company, of Philadelphia, has completed a pair of large centrifugal pumping engines for the United States Navy Yard at Mare Island, California. Each pump weighs 165,000 pounds. The cylinders are 28-inch diameter by 24-inch stroke. The pumps are over 11 feet in diameter, and each has a capacity of 40,000 per minute. All the pump pipes are 42 inches in diameter. Each engine drives a pump directly, and each acts independently of the other. The engines are supplied with the Porter-Allen link motion.

IROQUOIS, ONT., November 19th.—The Iroquois Water Works Company will have water through the town next week. On Tuesday morning Mr. W. Henry Patton, of the *Times*, at the request of Mr. W. Perry, jr., chief engineer of construction, gave the first turn on the brakes, which started the giant wheel, and in less than a minute there was thirty pounds of air pressure on the two Knowles' pumps. These pumps are capable of displacing five hundreds gallons of water per minute. The village will have the most complete system of any place in Canada. R. H. Buchanan & Co., Montreal, are the contractors.—Montreal *Star*.

THE SEWERAGE OF ORANGE, N. J.—A joint committee on the sewerage and drainage of Orange N. J., has just made its report to the Council of that town. This committee was appointed by the Mayor on April 6, 1885, and secured the services of Messrs. Bassett & Nute, Civil and Sanitary Engineers of Newark, N. J., to make the proper surveys and examinations. The report of these engineers is briefly as follows: They recommend the separate system and estimate for a population of 41,000, with 100 gallons of sewage daily per capita, and an allowance of 30 inhabitants per acre. For disposal, they suggest a gravity sewer 20 inches in diameter, uniting with the East Orange system, and running to a pumping-well, 15 feet in diameter in the north east section of the township; from this well it would be pumped through a 14-inch main to William street and Arlington avenue, whence it would flow in a 30-inch sewer through the towns of South Orange, Clinton and Elizabeth. An independent connection with tide-water is too expensive for consideration, so they propose a chemical precipitation with salts of alumina and iron, and a little lime, and intermittent downward filtration. Another suggestion for disposal is to connect by the Newark sewage, and pay proportionally for the pumpage. The estimated cost of a complete system of thirty-five and one-half miles of sewers to serve 41,000 inhabitants, is $217,134. The cost of 17 miles of sewers to provide for present needs would be $109,191. Outside of the city system, to connect with Newark would cost $120,312; with purification grounds (independent of East Orange), $56,485; purification grounds with East Orange, $61,325; Newark Bay alone, $148,444; Newark Bay with East Orange, $189,392; The annual cost of maintenance is estimated on the line to Newark, $9,013; purification with East Orange, $9,290; Newark Bay with East Orange, $9,997.40; purification alone, $10,024.45; Newark Bay alone, $15,122.20.

THE Bridgewater Gas Company has struck a gas well of tremendous power near New Sheffield, Pa.. The tools were blown out of the tube and over the top of the derrick, which is seventy-five feet high. A gauge on the well showed the pressure to be 480 pounds to the square inch, which makes it one of the largest wells ever struck. The gas is for use in the Beaver Valley.—Pittsburg *Commercial Gazette*.

THE artesian well, 400 feet deep, which was sunk a year ago at the Union Pacific Hospital, at Denver, Col., has just been deepened to 675 feet, with a bore of four and one-quarter inches. A flow was struck at 665 feet, with a pressure of fifty pounds to the square inch, and a capacity of 250,000 of soft water daily at 65° temperature. Grosmeyer & Co. did the work.—Denver *Tribune Republican*.

THE plans for the extension of the water works, supplying Brooklyn from Rockville Center to South Oyster Bay were sent to the Common Council on the 23rd. They provide for an enlargement of the reservoir at Ridgewood, increasing its capacity 160,000,000 gallons. At Milbun the reservoir will cover 70 acres, with a capacity of 400,000,000 gallons. The cost will be $3,000,000 and if approved it will take four years to complete it.

A COMPANY offers to build water-works for Sing Sing, N. Y., drawing its supply from Rockland Lake, on the opposite side of the Hudson, about four miles distant, on condition that the village agrees to take and maintain 100 hydrants for the streets at an annual expense of $6,000. The company also agrees to provide houses of not more than six rooms with water at the rate of $6 a year. After getting everything in perfect running order it will sell the works to the village, if it wants them, at an advance of 10 per cent. on the original cost.

WATER POWER MEASUREMENTS.—It may be interesting to know that the standard of taxation for water-power on the stream, as furnished to the city of Fall river by its experts, Prof. Charles E. Emery, of New York, and Mr. William Rotch, of Boston, formerly the engineer of the Water Works Department there, is at the rate of $19,314 per horse-power, or a capitalized valuation of $321.90 per horse-power. On this basis, the Troy Mill is taxed for its water-power $32,731, the Pocasset Manufacturing Company $116,388, Watuppa Mills $41,951, Quequechan Mills $27,276, Fall River Manufacturing, $39,441, Anawan Manufacturing $40,178, Fall River Iron Works Company, $46,370—making a total valuation of the water-power taxed by the city, $344,335. A careful measurement of the stream has also been made, and the test subjected to the criticism of the city's experts. The measurement covered a period of three years, and the result is that the capacity of the stream has been an average of 25,225,400 gallons flow of water per day. These figures were reached in the course of the recent litigation between the city and the mills on the subject of taxation, and have been accepted by the various corporations as a final basis of taxation. This would make at the rate of $18.80 per thousand, a total yearly revenue to the city from the water power of $6473. The old method of taxing this water power was upon the supposition that the average daily flow was about 32,000,000 gallons, instead of about 25,000,000, as above given. The estimated value, however, per horse power was lower, so that the city now receives from a less quantity of water power a considerably larger tax.—Providence *Journal*.

DRAINING JERSEY MEADOWS.—The question of reclaiming the meadows and marsh lands between Newark and Jersey City grows more important every week, and is now occupying the attention of half a dozen societies and the sanitary authorities of three or four cities. Col. George L. Gillespie, the United States Engineer, who had charge of the dredging of the Passaic river not long ago, said to a reporter: "Of course, the Newark meadows can be reclaimed, and the people of Newark will be compelled in time to reclaim them for sanitary reasons. All such meadow lands are malarious. These meadows can be made useful for business purposes. I don't see why the same rule that has successfully applied to other portions of the country should not apply in this case. The Potomac flats, for example, were as bad as those near Newark. Yet they are now being reclaimed because the health of the people demanded it. As an instance nearer home, there is Harlem. All these lands have been more or less reclaimed. In Boston the most expensive residences are build on land reclaimed from the Charles river. This work of reclaiming could be done by building dykes and filling in behind them, either with ashes or sand. No vegetable matter whatever should be used. Ashes constitute excellent material and act as a deodorizer. Sand is about as good, being porous and easily drained. The cost of such a process would largely depend upon the distance the filling would have to be carried. At there are no high ridges near from which the supply could be taken, it would have to come from foundries some distance from the dumping grounds. The cost would consequently depend, to a great extent, upon the value of the labor employed. I would roughly estimate the cost at twenty-five cents a cubic yard, but it might be done for less. The cheapest plan would be to use sand. This could be taken from the bed of the Passaic river and pumped directly on the meadows."—New York *Mail and Express*.

NEWS OF THE WEEK.

Miscellaneous.

Chinamen.—Thousands of Chinamen who were discharged on the completion of the Canadian Pacific Railway are said to be making their way into the United States.

The River and Harbor Convention in session at Tuscaloosa, Ala., November 18th, adopted a resolution in favor of liberal appropriations for river and harbor improvements in all parts of the United States, but refused to endorse the Eads ship canal scheme on the ground that it was not a proper subject for discussion.

A noteworthy building just completed is the $20,000 hospital at Salida, Col., built by employes of the Denver and Rio Grande road from a fund started two years and a half ago, to which each employe of the road has contributed fifty cents a month from his earnings. It is rated the best hospital in the State. Each cot has an electric call; the building is heated by hot air, and the light is controlled by curtains and colored glass traps. A similar building will be erected at Denver, after which the proceeds will be invested, the income to be used in aiding the families of employes who die in the service and those receiving permanent injuries.

City finances, as a rule are badly managed. An ordinary business man could take the money paid annually, make all the improvements now made; pay for all the work and services performed, and annually reduce the obligations at a rate that would wipe them out in a remarkably short time, without increasing the tax burden. The truth is, that in the election of men to serve in our councils, and fill our city offices, very little attention is paid to real qualifications. The question is, can he carry his ward, or has he a standing as a ward worker; qualification for the place is a question never asked, or a matter never sought. Fort Wayne *Gazette*.

Temperature of the Earth.—The German Government is having a deep shaft sunk near Schladebach, with the view of obtaining trustworthy data concerning the rate of increase in the earth's temperature as we descend into the interior. The excavation is being carried on by a diamond-tipped borer driven by water. At the beginning of 1885 the shaft had reached a depth of 4,640 feet. The temperature at successive stages is ascertained by an instrument which serves as a special thermometer, the principle of construction being that, as the heat increases, the mercury will expand so as to flow over the lip of a sufficiently short open tube in greater and greater quantities. The measurement of differences of these overflows will give the rate of increase of the temperature. It has been ascertained that the temperature at the depth of 4,640 feet was 130 degrees Fahr. If the temperature increases regularly at this rate, the boiling point of water ought to be reached at a depth of 10,000 feet.

Contracting.

Soldiers Monument.—The G. A. R. of Kankakee, Ills., will probably erect a $6,000 soldiers monument similar to the one at Middletown, Conn.

U. P. Depot.—The contract for the new addition to the Union Pacific headquarters at Omaha, Neb., has been let to J. F. Coots, the builder of the new Douglas County Court House.

Ten Tons of Powder.—The Glendon Iron Company at Easton, Pa., made a blast in their limestone quarries on the 21st that shook the earth for miles around. Ten tons of Judson powder were used, and it is estimated that 150,000 tons of stone were dislodged.

Highway Bridge.—A subscription is being taken in Kankakee, Ills., to secure money to build another highway bridge over the river west of that town. Over half the amount has been subscribed already by the farmers on the west side of the river.

Illinois Tile Industry.—A correspondent in the Chicago *Tribune*, claims that Illinois has $5,000,000 invested in the tile industry; the total out-put of the mills being over 50,000 miles per year. The above sum does not include the expense of the large canals used for outlets for the tile drains.

Kansas Prospects.—C. W. McCracken, who is engaged in railroad contracting, said on Saturday last that he had just secured a contract for building 276 miles of road in Kansas, which is to serve as a feeder for the Missouri Pacific. That road will build about a thousand miles of similar branches in the coming year. The prospects for railroad construction in the next two years are said to be greater than at any time in ten years.—*N. Y. Tribune.*

The St. Paul Carnival.—Small-pox has put a complete quietus on the Montreal Carnival; other cities, however, see "millions" in the attraction of the winter sports, and already St. Paul, from the region of blizzards, is in the field with a picture of the Ice Palace. It is described as follows: Building to be 260 feet long, 130 feet wide, containing a 30-foot driveway, skating rink, restaurant, dressing rooms, dancing halls, etc.; all lighted by electric light. At the head of the enterprise are many of St. Paul's millionaire wholesale merchants, and it will be the grandest affair of the kind ever attempted on this continent.

The columns, blocks, etc., used in the construction will be cemented by water and frozen together. The architecture is of the style known as "baronial;" the height of main tower to be about 130 feet. The projectors will spend nearly $200,000 on the carnival preparations. The "palace" will cost about $15,000.

Unbalanced Bids.—The *Evening Telegram*, of November 19, is authority for the following exhibit of some late unbalanced bidding in connection with the Public Works Department of New York:—The work in question was the grading of 95th street, between 10th avenue and Riverside Park. Bids were opened in the summer of 1883; one contractor offered to do the entire work for $25,000, and the earth bids ranged from 39 to 40 cents per cubic yard; rock, $1.25 to $1.50; flagging 25 to 30 cents per square foot, and curbing from 45 to 60 cents per foot. The original estimate of the surveyor was 18,000 cubic yards of earth including slopes, and 6,800 cubic yards of rock. At the time of letting, these figures were practically reversed by some mysterious manipulation, so that bids were asked upon 2,000 yards of earth and 19,000 yards of rock. When the bids were opened it was found that a Brooklyn contractor had put in proposals at $8.00 per cubic yard for earth and one cent per yard for rock and the same figure per item for flagging and curbing. On this basis his bid figured on the probable quantities stood at about $16,000 and was the lowest; he received the contract and went to work in May, 1883. The grading could have been finished in four months, but the lucky contractor is still at work upon it and has sold the stone at $1.00 per cart load and the earth at a good price; he has also paved with part of this material three adjoining blocks on 10th avenue and 92nd street, being paid for this by the property owners. The relative quantities of earth and rock have again changed places in the monthly estimates and the present exhibit of profit and expenses stands as follows:—

23,600 cubic yards of earth, at $8.00	$188,800
Rock, flagging and curbing, at $0.01	600
Sale of rock and earth, and grading side streets	20,000
Total	$209,400
Deduct for expenses	16,000
Profit, eas dividends	$193,400

If the figures of the lowest bidder were attached to these same quantities as returned, the account would stand as follows:—

23,600 cubic yards earth, at 30 cts	$7,080
3,500 " " rock, at $1.25	4,375
Flagging and curbing	4,500
Total	$15,955

According to this accounting, the city loses just $193,445, or deducting the $20,000 obtained from side work and sales of material, $173,445.

Railroads, Bridges and Canals.

Dry Dock.—A movement is on foot at Brunswick Ga., to establish a dry dock at that place.

Town Hall.—The taxpayers of Seekonk, R. I., have voted to build a Town Hall.

Brick Pavement.—Decatur, Ills., expects to lay one or two miles of brick pavement next year.

Zuyder Zee.—The project of drying up the huge Zuyder Zee is being urged in Holland.

The Burington & Missouri has surveyors out on the extension from Ashland, and as soon as a route is selected will rush the construction of the road.

The Apopka Canal connecting Lake Apopka, Fla., with the chain of lakes north of it, is being widened and deepened.

Pennsylvania R. R.—The rails on the Schuylkill Valley Division of the Pennsylvania Railroad were laid to the Hamburg depot on the 20th.

Alabama R. R.—Work will be commenced on the first day of January on a road from Gadsden to Jacksonville, Ala. This road will connect the Alabama Great Southern with the East Tennessee, Virginia & Georgia, Georgia Pacific and East & West.

A New Road is talked of from Mt. Carmel, Ill., to Henderson, Ky., crossing the new Henderson bridge. The road will be built by the Cairo, Vincennes and Chicago line, and will be twenty-three miles long.—Louisville *Courier-Journal.*

A Novel Project.—Notice is given of the intention to apply to the Dominion Parliament for authority to construct a subway under the Northumberland Straits to connect Prince Edward's Island and New Brunswick between Cape Tormentine and Cape Traverse.

Mission Ridge R. R.—A charter was applied for for the Mission Ridge Railroad, Tenn., on the 17th. It is proposed to build a railroad from Chattanooga to Missionary Ridge, thence along the base of the ridge from Rossville to the river, also from the wharf to the foot of the mountain.—Atlanta *Constitution.*

The San Antonio and Aransas Pass Railroad is still building towards the Gulf, and the stock counties along its proposed route are active in bidding to secure the road. There are two routes of about equal directions; one via Goliad County, the other via Karnes, Live Oak and Bee Counties.

Electric Bell-Rope for R. Rs.—The Chicago and Alton R. R. is experimenting with an electrical device as a substitute for the bell-rope. A conductor's signal gong is placed in the cab, and also in the baggage car to make the baggage man a witness to check the engineer. An engineer's gong is placed in each car.

The Nebraska & Northwestern.—Fifty-five miles of the proposed route of the Nebraska & Northwestern Railroad have been surveyed. The line has been staked to Holton, county seat of Jackson county, Kansas. The grades are easy, and the work of building will begin immediately.

A Chinese Railway.—A line is about to be constructed from Takan, at the mouth of the Horn-Ho, on the Yellow Sea, to Tong-Chow, on the Pie-Ho, an affluent of the Hoen-Ho at a point about 25 miles east of Pekin. The line will be an important work; it will be about 100 miles long, and will give Pekin a direct and easy communication with the Yellow Sea.—London *Engineering.*

Norfolk & Western.—A despatch from London states that President Kimball, of the Norfolk and Western Railroad, has succeeded in placing with a syndicate about $600,000 of the improvement and extension mortgage bonds at nearly par. This will enable the road to complete the Cripple Creek extension.—Philadelphia *Press.*

The Chicago, St. Meinrod & Ohio River Railway Company, has been incorporated at Indianapolis, to build an extension of the Jasper, Orleans and French Lick Railroad, which is connected with the Ohio & Mississippi Railroad at Orleans. The extension will be thirty-five miles in length, running from Jasper, Dubois County, toward Tell City and Cannelton. B. F. Westfall of St. Louis holds 474 of the 500 shares of capital stock of $100 each.

The Merrill & Abbotsford Railroad Company has filed articles of incorporation. The road is to extend from Merrill to Abbotsford, Wis., and its length will be about thirty-eight miles, passing through the counties of Marathon, Lincoln and Clark. The capital stock is $500,000 divided into 5,000 shares of $100 each. The incorporators are Fred Rietbrock, A. A. Krause, and T. H. Malone, of Milwaukee, H. W. Wright, W. A Scott and P. B. Champagne, of Merrill, and J. H. Coolridge.

Pine Creek R. R.—Application has been made to the New York Stock Exchange by the Pine Creek Railway Company to list $3,500,000 first mortgage bonds bearing 6 per cent. and running for sixty years, issued for the purpose of constructing the road, which was chartered by the State of Pennsylvania. The bonds are guaranteed by the New York Central, the Reading and other roads, jointly and severally, both principal and interest.—Philadelphia *Press.*

James River Valley R. R.—The laying of track between La Moure and Jamestown was completed on the above road on the 16th inst, and the road will be opened for operation upon Tuesday, the 1st of December next. The following stations have been established, Jamestown, D. T.; Ypsilanti, 12.8 miles; Montpelier, 18.9 miles; Dickey, 32.5 miles; Grand Rapids, 41.1 miles; La Moure, 48.7 miles. Mr. Edward Barrington is the engineer in charge.

An Improvement in Steel has been made on the Bessemer steel process at the Edgar Thomson Steel Works, which, it is said, will have the effect of making Bessemer steel equal in quality to crucible steel, while it will cost only about one-tenth of the price. The change consists in a thorough mixing of spiegel iron, or manganese, with molten iron in a ladle so as to uniformly carbonize it. Bessemer steel can be produced at a cost of 1 cent to 1½ cents per pound, while that made in crucibles costs at least 11 cents per pound.

Kings County Elevated R. R.—On November 24th, at a special meeting of this company, Mayor Low's terms, as set forth in his letter of the previous day, were accepted unanimously and resolutions were drawn up binding the company to exact only a five cent fare, to begin promptly and build rapidly, to operate the portion of the route for which it applies if it builds on it, whether it gets further rights or not, and to give a bond for $200,000 to guarantee the city against loss. Messrs. Reeves and Bonzano, of the Phœnix Bridge Company, were notified by the Company to get ready to proceed with their contract at once. They will probably begin on the foundations right away, and on the iron work in two weeks. They will begin at two places at once.

To Arrange for a Bridge.—Receiver Levy, of the Shreveport and Houston Railway, is in receipt of a dispatch from Receiver Howe, of the Houston, East and West Texas Narrow-gauge, that he will reach the Sabine river on the 18th and asks him to meet him there and arrange for the speedy construction of the bridge over the Sabine.—*Globe Democrat.*

To Bridge the Missouri.—It is reported that the Burlington and Missouri River Railway Company has placed a contract for building a permanent bridge across the Missouri River at Rulo, Neb. The work on the bridge is to be commenced this winter and will be completed early in the spring of 1886. The plan upon which the piers for the bridge are to be sunk can be carried out much better in winter than summer.—*Globe Democrat.*

The Proposed New South Carolina Road.—A meeting of the executive committee of the proposed South Carolina narrow-gauge road was held at Ninety-Six on the 14th, at which it was resolved to at once take initiatory steps toward grading the road from Johnston's to Greenville. The first assessment upon subscribers was ordered, and the chief engineer, Captain Kirk, was instructed to organize an engineer corps to locate the line. Captain Kirk states that he will have a corps at work in two weeks, and that the contracts for grading will be ready for letting by January 1. The work will begin at Ninety-Six in both directions, toward Johnston's and Greenville, and possibly a third working force will begin at some point higher up the line.—Savannah (Ga.) *Morning News.*

How the Mexicans Make a Grade.—An engineer who had contracts all over the new world stood on a corner watching surveyor, linemen and stake carriers elaborately laying off the work for a gang of street graders. "Do you know how I'd do that thing if I was in Mexico?" he asked. "I'd go up to that end and I'd drive a stake with the top just where I wanted the grade to come. Then I'd go down to the other end of the street and I'd drive another peg with the top where I wanted the grade there. I'd say, 'Arriba.' Those Mexicans would jump in, and they'd grade that whole street from end to end by those two stakes, and when they got through there wouldn't be an inch too much or an inch too little dirt anywhere on the line. Use a line? Not much. They'd do it all by those two stakes and their eyes. Those fellows build miles and miles of irrigating ditches along hillsides and through fields without any surveying. When they turn the water in it moves right along, doing the work just as they meant it. They don't know what a level is but they don't make any mistakes when it comes to grading."—*Exchange.*

The Bolan Railway.—The Lower Bolan railway, which brings the Belooch frontier into connection with India to within 40 miles of Quetta was formally opened about Nov. 1. In the Sibi railway section the bridge over the Indus, an important link with the Punjab, is unfinished, but the portion of the bridge over the Sukkur fork—about 600 feet long, supported midway on a foundation of rock, is already completed. The rails on it are connected with the railway on the Kurrachee side, and extend for a further length of about 1,200 feet across the island. The lines are also laid on the opposite or Punjab side, up to the river, and the abutments on either side of the Rohri channel are ready for the principal portion of the bridge, which will be 830 feet long. Work has been stopped since March, awaiting arrival of the steel work from England. This is expected to reach India in about 12 months, when the building of the bridge will be resumed. The portion of the bridge over the Rohri fork will be a single span designed on the same principle as the Forth Bridge, and will be built out gradually from either side, the erection of staging to facilitate the work being impossible, as the banks fall down sheer from the abutments. The Sibi railway continues two miles further, to Pirchowki. Here the Lower Bolan railway commences, and is continued on the same broad gauge. The lines hence are laid on the old bed of the river, the present stream has cut its way through to a lower level, and the railway occasionally crosses it by low "crib" bridges made of piles of sleepers laid one above the other, firmly screwed together, and weighted with boulders, the force of the stream being sometimes lessened by stone weirs. The piles have become firmly imbedded, and, whatever the effect of unusually heavy floods, there is no fear of their foundations being impaired. Near Darbar the river flows into the Bolan, and above this point there is no danger whatever to the lines from floods. Mutch, where the Lower Bolan railway terminates, is reached after fifteen miles. The broad gauge will run along ground of the same character as below Mutch for seven miles, where inclines and curves will necessitate the narrow gauge. Darwaza, on the plateau, is about 20 miles above Mutch, and Quetta is adout 20 miles beyond Darwaza. When the lines reach the plateau, the country will present no engineering difficulties, as it lies flat and even up the Kojak. The present engineer-in-chief is Mr. O'Callaghan, who succeeded Colonel Lindsay when the latter was obliged to go away on sick leave. He earned a high reputation as engineer of the Attock bridge, which he has increased by his present work. The completion of the line thus far is said to be of incalculable advantage strategically.

Milton and North Mountain Railroad Company, Capital stock $200,000. The line will extend from Milton, in Northumberland County, Pa., to a point near Millville, in Columbia County. Survey commenced.

Sale of the West Shore Railroad.—The West Shore Railroad was sold on the 24th, at Newburgh, N. Y., to J. Pierrepont Morgan, Chauncey M. Depew, and Ashbel Green for $22,000,000. There was only one bid.

C. B. & N. R. R.—GALENA, ILLS., has granted the Chicago, Burlington and Northern R. R., the right to enter that city, and also to construct a single track bridge across the Galena river at that point.

The Ivesdale, Ills., Ditch drains 21,000 acres of land. The highest assessment per acre is $5 and the lowest is 25 cents; average cost per acre, $2.40. Total cost of ditch will be $50,400. Average width of ditch is 35 feet, depth 7½, length fifteen miles.

New R. R.—The Gorham, N. H., *Mountaineer* hears a report that a number of wealthy Maine men are debating the feasibility of a railroad from Gorham to the Glen House. The estimated cost of grading is $100,000.

R. R. Extension.—Milwaukee and St. Paul Railroad officers announce that the Board of Directors have decided to push forward the road's Kansas City extension at once, and have given an order for a large quantity of new steel rails, said to be 10,000 tons.

The Milwaukee & Northern Railway Company has submitted propositions to Kewaunee and Door counties for the construction of a line that shall touch at Kewaunee, Ahnapee and Sturgeon Bay. Door county is to pay a bonus of $38,000, and Kewaunee one of $42,000.

St. Louis and San Francisco R. R.—During three days of last week, eighty trains, with a sufficient force of men, necessary implements and usual camp followers unloaded at Red Fork, Indian Territory, to commence work in earnest on the extension of the St. Louis and San Francisco Railroad.

A Drainage District has been organized at Pesotum, Ills., to construct another of those large ditches which seem to be so numerous in Illinois. Lewis Reinheart, David Devinev and Benjamin Gardiner, are commissioners, post office Pesotum. The contract has not been let, or advertised.

The Texas Trunk Railroad was sold at public sale on the 19th, for $250,000 to W. W. Weigley and associates, of New York, who will at once begin its extension to Athens, Henderson county. It is the intention of the purchasers to complete the railroad to tidewater, either by building to Sabine Pass, or by connections with New Orleans.

Canadian Pacific R. R.—A Portland despatch states that over twenty miles of road and the new bridge at Lachine, now under contract by the Canadian Pacific, are needed to make a direct and continuous line from Port Moody, on the Pacific Ocean, to Halifax, St. John, Portland and Boston, with a side track into New York. The Portland and Ogdensburg holds the key to the mountains and Canada, and with the control of that passing into the hands of the friends of the Boston and Maine and Canadian Pacific, the entire system will be brought under one management.

Storm King Bridge.—William V. Smith, Chief Engineer, has filed in the office of the County Clerk at Goshen a mortgage for $6,000,000 signed by Chauncey Vibbard, President of the New England and Southwestern Railroad, to the Central Trust Company of New York. The mortgage covers the line from the Erie connection to Brewster's, twenty-six miles, including the projected bridge over the Hudson at Storm King. The Phœnix Bridge Company has the contract to build the bridge. Four prominent railroad men will become Directors. The bonds have been taken and a syndicate is now being formed.—*Associated Press Item.*

Chicago, Burlington and Northern R. R. Bridges.—The bridge across the Chippewa river will consist of 2,000 feet of trestle, seven fixed spans of 140 feet center to center of piers, and one draw span, to be operated by steam, 322 feet center to center of piers. The piers are to rest upon piles. The sand is about 90 feet deep, above the bridge there will be a brush and stone dam 800 feet long, and a wooden boom 1,200 feet long, for the benefit of raft navigation. The bridge site is about four miles above Wabasha, Wis. The Union Bridge Co. has the contract.

The Wisconsin river bridge, one and one half miles above the mouth, will consist of one span 199 feet, three of 117, six of 177, and a draw span of 236 feet; the draw is to be operated by hand. Piers rest on piles in 90 feet of sand. Contract let to Union Bridge Co., for bridge complete.

The St. Croix bridge, at Prescott, Wis., near the mouth of the St. Croix river, consists of one fixed span 153 feet, and a draw span 367 feet, with three-quarters of a mile of framed trestle work. Union Bridge Co., has contract for bridge complete.

The Galena river bridge is a draw of 268 feet operated by hand, of which Detroit Bridge Co. are the contractors.

Canadian Railway Contracts.—The Dominion Government have awarded contracts for the construction of the different sections of the Short Line Railway to the International Railway Company, of Sherbrooke, Quebec. The proposed Short Line Railway is to connect Montreal with the harbors of St. Johns, New Brunswick, Halifax, and Louisbourg, and the portions to be built are about 250 miles in the State of Maine, sixty miles in Quebec, and about ninety miles in New Brunswick. The Dominion Parliament has granted subsidies aggregating about $9,000,000, toward its construction and the purchase of roads to form portions of it, but the company that secures the contract will own and operate the whole line when it is completed. It is also understood that the Government will hand over to the new Short Line Company that portion of the International Railway between St. John and Halifax. The International Railway Company, to which the contract has been awarded, is composed of members of the Canadian Pacific Railway Company, and Mr. Ives, member of Parliament. J. H. Pope, Minister of Railways and Canals, was President of the International Company until a few days ago, when he resigned. The Short Line will, when completed, form part of the Canadian Pacific Railway system.

The B. & O. reaches New York.—The *Sun* of this city is authority for the statement, that the Baltimore & Ohio Railroad Co., on November 21st, ratified a contract with the Staten Island Rapid Transit Co., by the terms of which the first named company secures the control of two miles of deep-water front, over 150 acres of land, and all the dock and ferry privileges of the Transit Co. This secures to the B. & O. R. R. entrance into New York by way of its own line to Philadelphia, by the Philadelphia & Reading to Bound Brook, and from there to Elizabethport by an eighteen mile railway to be built at an estimated cost of $1,500,000. At the latter point it will connect with the Rapid Transit Co's line by an iron bridge 600 feet long, over the Arthur Kill. This bridge is to be built by the Transit Co., at a cost of about $300,000, and the contract is said to be let. The contract between the B. & O. and the Transit Co. guarantees the principal and interest of the bonds of the latter company, amounting to about $2,000,000, and the B. & O. also acquires one-half of the $500,000 stock of the Transit Co. The road of the last named company runs from Elizabethport to St. George's Point, the nearest land on Staten Island to New York City, and it will be completed in about one month. Fast steamers are proposed that will reduce the time between the island and the city to fifteen minutes; and it is expected that the distance between the Battery and Bound Brook can be covered in one hour.

Argentine Railways.—The London *Railway News*, speaking of these roads, says: The rails are nearly all of steel, except upon the old roads, and came from England, as well as the other construction material. The ties are of native wood, as hard and heavy as iron, and will sink in water, and although very expensive to lay, will last a century. Our contemporary's informant is right as to these details of contracts, but is assuredly wrong in the statement that "the locomotives are nearly all from the United States," and that "the American cars are more popular and will ultimately be adopted upon all the roads." As a matter of fact, about 90 per cent. of the locomotives are from England, a large proportion being built by Beyer & Peacock, of Gorton, near Manchester. The Southern company began buying these engines, and the results were so good that both the government lines and those owned by English companies have followed suit, and with the most beneficial results. Some engines built in Belgium for one of the lines are officially reported to have turned out less satisfactory than the English, although built at a much lower cost originally. The Baldwin company (America) have built a few engines and bear a good reputation, but they do not, we are informed, run the English manufacturer very hard, except in cases where undertakings do not like to face a heavy original cost. A few American passenger cars have been imported, but as a rule the carriages and wagons—many of them of the American type—are built in England. On some large lines, like the Southern, where they have good machinery, the ironwork for the wagons is sent out, and the woodwork is prepared and the wagons are erected on the spot. Pitch pine is the wood generally used, and it is imported direct from the southern states—chiefly from Galveston and Darien. All the lines are laid with steel rails—the greater part from England and chiefly from the Cammells, of Sheffield. Some contracts have been taken in Belgium in competition, but there is a prevailing preference for English rails. Many lines are laid with ironpot-sleepers of what is called the "Livesey" type; some are laid with hard woods, but the material is costly and difficult to work, and there is an idea that no transverse sleeper answers so well as the "pots," for there is practically no ballast in the country, and the rails are laid upon the natural soil. This answers excellently in the dry weather, but with the heavy semi-tropical rains the road-bed becomes saturated and spongy, and gradually becomes little better than a bank of mud. The transverse sleepers are supposed to aggravate this evil by "churning" the mud over the entire surface whenever a train passes.

Huntingburg, Tell City and Cannelton Railroad. The proposed line is thirty-five miles long, from Cannelton to Huntingburg, Ind., where it will connect with the Louisville, New Albany and St. Louis R. R. and be operated in its interest. The capital stock is $420,000.

Four Little Roads in Maine.—There are four railroads in Maine of only two feet gauge, the ordinary narrow-gauge being three feet. The roads mostly cut into the wilderness, have sharp grades and curves, and rush an increasing passenger traffic along at from twenty to forty miles an hour. The cars seat thirty-five people each.

Connecticut Air-Line.—The report of the New York & Cincinnati Air Line railroad (the Olmstead parallel), up to March 22, 1885, has been filed in the office of the Secretary of State. It shows expense for excavations, etc., $18,098; work done by contractors, $19,367; right of way, $15,716; engineering, $1,844; making a total of $55,027.

American Stocks in England.—Owing to scrimmages on the street arising from dealings in American stocks, an influential firm of brokers has presented a petition to the Board of Managers of the Stock Exchange asking that after the regular business hours of the Exchange the American market be removed to a covered space, and that after 5 o'clock all dealings in American securities be prohibited.

The Topeka, Frankfort and Marysville Railroad Company is to erect a standard-gauge line from Topeka to Marysville, Marshall County, via Frankfort; estimated length, eighty miles; of branch, thirty miles. The headquarters of said road to be at Topeka, Kansas; capital stock, $200,000. The Directors at Topeka are: A. H. Williams, H. P. Dillon, Geo. W. Veal, Jacob Smith and Lester S. Wilson.

The Oakland and Colby Railway Company is to construct a road thirty-five miles in length, from Oakland, St. John County, to Colby, in Thomas County; place of business, Topeka, Kansas; capital stock, $1,500,000. Directors for twelve years are as follows: A. L. Williams, H. P. Dillon, Geo. W. Veal, Jacob Smith, Lester S. Wilson, all of Topeka; R. W. Jenkins, Clay Center; Chas. Monroe, Lawrence; D. D. Hoag, Wyandotte, and J. B. McGonigal, Thomas County.

The Burlington, Eureka & Beaumont Railroad Company was chartered at Topeka, Kan., on the 14th, with a capital stock of $1,000,000, for the construction of a railroad from Burlington, Coffee County, Kan., through the counties of Woodson, Greenwood and Butler, by way of Eureka, in Greenwood County, to Beaumont, in Butler County. The directors for the first year are S. A. Martin, W. B. Collins, J. P. Pierce, Ira T. Nye and J. B. Clogston, all of Eureka.

Railroad Prospects.—The price of steel rails and of pig iron have again advanced, while quotations of all the metals show a hardening tendency. This advance is due to a legitimate demand that has sprung up, not only for new railway constructions and repairs on existing lines, but on account of the heavier demand for all sorts of metals in the manufactures of the country. It is impossible to overrate the significance of this better demand for steel, copper, lead, iron, tin and the minor metals. It shows that the wheels of industry are again in motion with little possibility of an early stoppage. The demand for steel and iron from this time forth promises to be unusually large, due to the fact that new railway construction has set in on a scale of unexpected magnitude. In the Northwest alone fully 5,000 miles of new road have been marked out for early completion. There is probably twice as much more in the rest of the country, and this without taking renewals and repairs into consideration.

Happily the contemplated new construction does not involve any paralleling of main lines. Its object will be to complete existing systems, and will strengthen rather than impair their value. Connections will be made, productive feeders opened up, and extensions will be permitted where there is a reasonable certainty of profit. It now looks as though 15,000 miles of new railroad would be constructed by the close of the year 1887. In view of our increased population and wealth this will not be too great a strain upon the resources of the country, for it is not likely there will be any such follies as the repetition of the blunders made in the construction of the West Shore and Nickel Plate roads.—*Record & Guide.*

Railroad Building in Tennessee.

We reprint from the Nashville, Tenn., *American* the following as a summary of the most important railroad projects in that State:

"The continual efforts which are making in various parts of the State to increase our railway mileage is significant of better times. At present several distinct lines are proposed with an almost certainty that one or more will be built in the near future. First, there is the Chesapeake & Nashville Railroad, to be run from Nashville to Scottsville in Adair County, where it will join the Huntington system of roads. To that project the citizens of Nashville have subscribed for the bonds to the amount of $500,000. The prospects for the building of this road are favorable. The next most promising venture is what is known as the Nashville and Knoxville Road, to be built from a point on the Chesapeake and Nashville Railroad, three miles beyond Gallatin, to the Cincinnati Southern. Recent reports from along the line indicate that at least $200,000 will be raised by the citizens of the counties through which it is proposed to be built, in aid of the enterprise.

A company has also been formed, composed mostly of Pittsburg capitalists, for the purpose of building a railroad across the States of Kentucky and Tennessee. The line of the proposed road was surveyed from Evansville, down through De Koven, Kentucky, to Jackson, Tenn. It is to be called the Ohio Valley Railroad, and extends in a southwesterly direction, opening up a portion of country the richest in minerals and agricultural products of any part of the State. The line will be 200 miles in length, and the cost of building will not exceed $2,000,000.

Another proposed road is a narrow gauge from Clarkesville to Princeton, Kentucky, thirty miles of which are now in operation, with ten miles more graded. This road passes through a very fertile region and one that abounds in rich coal deposits. It penetrates the heart of one of the best tobacco growing regions in the West. The management, it is said, however, is in financial distress, owing to the failure of the subscribers to the bonds to pay promptly.

It is now feared that the road will pass into the hands of some other corporation and so deprive the citizens of Clarksville of an independent competing line. The tobacco receipts in Clarksville have been very largely increased by this road. Several other lines have been talked about, with more or less prospects for early completion. One of these is from Elora, in Lincoln County, to Huntsville, Alabama, and the other from Martin, in Weakley County, through Rives to Reelfoot Lake, in Obion County. This projected line would probably pass through the most heavily timbered district and the richest agricultural lands in the south. The entire distance is about thirty miles. If it could be carried across the lake so as to reach Tiptonville, in Lake County, it would give the most direct route from Nashville to the Mississippi River.

The Chesapeake & Nashville Road will be the most important of all that are projected to the trade of Nashville. It will give a competing line to the East, and pass through a section of the country rich in agricultural and mineral wealth. The next in importance to Nashville is the Nashville & Knoxville, projected, but which will open one of the finest timbered regions in the State, and tap a coal region which will supply a quality superior for the domestic to any now brought to the Nashville market."

Market Report of Engineering Materials.

New York, November 26, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.			
Angles		1.95 @	2.00
Tee		2.25 @	2.35c.
Beams and channels American		3.0c. @	
Tank		2. @	2.1c
Shell		2.4c. @	2.5c
Steel plates, Tank		2½c. @	
WROUGHT-IRON PIPE, PITTSBURGH.			
Butt welded, black	Discount	42½ @	45
" " galvanized	"	32½ @	35
Lap welded black	"	60 @	62½
" Galvanized	"	45 @	42½
Boiler tubes		55	
RAILS.			
Steel (large lots at mill)		34.00 @	35.00
Old rails		18.50	
Old rail steel		18.00 @	19.00
R R. spikes		2.10	
R R. splice-plates		1.75	
R R. Track Bolts Square Nuts		2.75	
Barb-wire fencing, galvanized		4.35 @	4.50
" " painted		3.35 @	3.50
Corrugated iron			
Nails			
Iron, per keg		3.25	
Steel do.		3.35	

METALS.

COPPER.		
Lake Superior	10.95 @	11¼
Other Brands	9.75 @	10.20
LEAD.		
Com. Domestic		4.35
Lead Pipe	.05¾	
Tin-Lined Lead Pipe	.15	
Sheet Lead	.05¾	
ZINC.		
Sheet	5.70 @	5.90

BRICK.

Cargoes afloat)		
Haverstraw, per M.	$5.75 @	6.25
Fishkill		
Up-River	5.50 @	6-12½
Jerseys	5.00 @	5.75
Long Island		
" pale	3.00 @	3.50
FRONTS.		
Croton red	11.00 @	14.00
" dark	11.00 @	14.00
" brown	10.00 @	13.00
Philadelphia pressed	24.00 @	25.00
Trenton "	24.00 @	25.00
Baltimore "	37.00 @	41.00
Buff "	33.00 @	35.00
Enameled English	65.00 @	130.00
" American	85.00 @	120.00
Fire brick	25.00 @	40.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

BAETJER & MEYERSTEIN:		
Hanover Portland	$2.60 @	$2.65
BELLONI & CO.:		
Hemmoor "Crown" brand		2.50
JAMES BRAND:		
K. B. & S	2.55 @	3.00
BROOKS, SHOOBRIDGE & CO.	2.55 @	2.60
HOWARD FLEMING:		
Gibbs' English Portland, 400 lbs	2.65 @	2.90
K. B. & S. " "	2.75 @	2.95
Stettiner, German	2.65 @	2.85
Lagerdorfer, "	2.45 @	2.75
Fieve, A 1, Belgian	2.35 @	2.50
Roman	2.75 @	3.00
Keene's Coarse	4.75 @	5.50
" Fine	7.75 @	8.50
" Superfine	8.50 @	10.00
FISHER, ERSKINE W.:		
Stettin (German) Portland Cement	$2.40 @	2.75
GABRIEL & SCHALL:		
Vorwohler "Lion"	2.65 @	3.10
HUDSON RIVER CEMENT CO. Rosendale		1.10
JOHNSON & WILSON:		
Saylor's American Portland	2.15 @	2.40
LAWRENCE CEMENT CO.:		
Hoffman Rosendale		
LESLEY & TRINKLE, Philadelphia, Pa.:		
"Giant" Portland	2.20 @	2.40
Improved "Union"	1.25 @	1.50
Union	1.10 @	1.20
MARCIAL & CO.:		
J. B. White & Bros. Coarse	4.50 @	5.00
" " Fine	8.00 @	10.00
" " Portland	2.45 @	2.85
NEW YORK CEMENT CO.:		
Rosendale		1.20
N. Y. & ROSENDALE CEMENT CO.:		
Rosendale, "Bridge" brand		1.10
SINCLAIR & BABSON:		
Alsen's Portland	2.45 @	2.75
STANDARD CEMENT CO.		
E. THIELE:		
Dyckerhoff	2.90 @	3.25
UNITED STATES CEMENT CO.:		
Windsor	1.00 @	1.10
Standard		1.15
Cable's Portland	2.15 @	2.40
UNION AKRON CEMENT CO.:		
Akron "Star" brand		

ASPHALT.

Prices range per ton	$15.00 @ 20.00
According to quantity or brand, and whether taken from vessel or store,	

LIME.

Rockland common per bbl	1.00
" finishing	1.20
State, common	.90
" finishing	1.10
Kingston, ground	0.95
Add 25c. to above figures for yard rates.	

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90 @	95
" " No. 2 "	0.75 @	0.80
" " light drab "	0.80 @	0.95
Berlin " in rough "	0.75 @	1.00
Berea " "	0.75	
Brownstone, Portland, Ct. "	1.00 @	1.30
" Belleville, N. J. "	0.75 @	1.25
Granite, rough	0.60 @	1.25
Common building stone per load	2.00 @	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.	0.40 @	3.00

SLATE.

Purple roofing per square	6.00 @	7.00
Green "	6.00 @	7.00
Red "	15.00	
Black Penna. (at New York) "	4.50 @	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00 @	20.0
Choice "	65.00 @	70.
Tally plank, 1¼ in. 10 in. dres'd. each.	.44 @	.50
Tally boards, dressed com. "	.28 @	.30
SPRUCE, Boards dressed "	.25 @	.28
Plank, 1¼ in "	.28 @	.30
" 2 in. "	.38 @	.40
" 2 in. dressed "	.43 @	.45
Timber per M.	20.00 @	22.00
HEMLOCK, Boards each.	.18 @	.20
Joist, 2½ × 4 to 4 × 6 in	.16 @	.44
OAK per M.	55.00 @	65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00 @	40.00
YELLOW PINE, Girders "	25.00 @	30.00
Dressed flooring "	28.00 @	35.00
SHINGLES, Extra shaved pine, 16in. "		
" sawed 18 in. "	5.75 @	6.00
LATH, Cargo rate	2.30	

PAINT.

Lead, white, American dry per lb	.04¾ @	.05
" " in oil pure "	.05¾ @	.06
English, B. B. in oil	.08½ @	.08¾
Red, American	.05¼ @	.05½
Litharge "	.05 @	.05½
Venetian red, American "	.01 @	.01¾
Indian red "	.05 @	.10
Vermillion, American lead "	.11 @	.11¾
Paris green "	.15 @	.20
Umber, Amer. raw and powdered per lb.	.01¾ @	.01¾
Drop black, Amer. "	.07 @	.13
" " "	.09 @	.11¾
Chrome green	.05 @	.20
Oxide zinc, American	.03¾ @	.04
" French	.06¼ @	.06¾